

[Price 10s.]

PROCEEDINGS
OF
THE LINNEAN SOCIETY OF LONDON



146TH SESSION

FROM OCTOBER 1933 TO MAY 1934

LONDON:
PRINTED FOR THE LINNEAN SOCIETY OF LONDON,
BURLINGTON HOUSE, PICCADILLY, W.1.
BY TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.

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1934

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PUBLICATIONS : FROM JUNE 1933-MAY 1934

Journal, Botany.

Vol. XLIX. No. 329.
 ,, 330.

Journal, Zoology.

Vol. XXXVIII. No. 260.
 ,, 261.
 ,, 262.

Proceedings, 145th Session, 1932-33.

List of The Linnean Society of London, Oct. 1933.

PROCEEDINGS

OF

THE LINNEAN SOCIETY OF LONDON

(ONE HUNDRED AND FORTY-SIXTH SESSION,
1933-34)

GENERAL MEETINGS

26 OCTOBER 1933

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the Anniversary Meeting held on Thursday, 24 May 1933, having been circulated, were taken as read and confirmed.

The President reported the deaths of the following Fellows of the Society :—Walter Barratt, Prof. W. G. Craib, Dr. E. Drabble, Prof. H. G. Greenish, C. C. Lacaita, Clive E. Lord, Dr. M. O. Malte, Dr. O. Stapf, H. F. Tagg, Hon. Geo. M. Thomson, and Ashley H. Maude.

The President stated that during the recess Dr. ALEXANDER ZAHLBRUCKNER, F.M.L.S., had celebrated the completion of fifty years' research in Lichenology, having taken his doctor's degree at the University of Vienna in 1883.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Major Arthur Algernon Dorrien-Smith, D.S.O., Frederick Robert Irvine, Rev. Canon Francis William Galpin, and William John Cooper Lawrence.

Issued 24 April 1934.]

Certificates of recommendation of the following candidates for Fellowship were read:—For the first time, in favour of Edith Dorothy Brain, Alexander Frank Fountain, Don Carlin Gunawardena, Robert John Aylwin Wallace Lever, Harold George Fisher MacDonald, Guy Walter Otter, Cyril Dean Darlington, and Frances Lotte Stephens.

Phyllody in *Tropaeolum majus*.

By Professor F. E. Weiss, F.R.S., P.L.S.

THE PRESIDENT exhibited a specimen of *Tropaeolum majus* in which the flowers showed various stages of phyllody. The specimen had been sent by Miss P. M. TAYLOR, F.L.S., who mentioned that the earlier flowers had been more or less normal in structure. The later flowers showed that the stages of malformation were first the development of the petals into spatulate leaves, next into peltate leaves. The calyx might also develop into spatulate leaves. The carpels formed an elongate ovary elevated on a distinct gynophore. The stamens were the least modified, but often showed leaf-like outgrowths from the base of the anthers. The various stages of modification were in close agreement with similar flowers described by Ziegler in 1880 (Ber. d. Senckenb. nat. Ges.), and since then observed by other teratologists.

Miocene Primates from Kenya.

By Dr. A. Tindell Hopwood.

THE paper contains detailed descriptions of the teeth of the three species *Limnopithecus legetet*, *Xenopithecus koruensis*, and *Proconsul africanus*. The first is compared with the Gibbons, of which group it appears to be a member; the second does not appear to have any close relationship to any known Primate, either recent or fossil; the third is compared with the Gorilla and Chimpanzee—it appears to be ancestral to the latter.

The paper concludes with a short review of the fossil Primates from Africa, and suggests a possible sequence of events in the evolution of the Anthropoids.

'Pelorus Jack'. By Dr. W. Rushton Parker.

DR. W. RUSHTON PARKER exhibited lantern-slides of Pelorus Jack alongside of a common dolphin, and of a *Ziphius*, pointing out the great differences, and also alongside of Risso's dolphin, showing the close resemblance in length, colour, beak-less snout, high dorsal fin, and flippers. He showed slides of the habitat of the creature near Pelorus Sound, in New Zealand, and the course of the steamers running between Wellington and Nelson, which it accompanied, often daily, for about

thirty-two years; also a slide showing the dates of the Orders-in-Council of the N.Z. Government protecting it from interference during the ten years 1904-14, under penalty of a fine of £5 to £100.

Dr. STANLEY KEMP remarked that the information on the length of life of this Dolphin was valuable. It had evidently lived for at least thirty years, a figure comparable with recent estimates of the age of Blue and Fin Whales. 'Pelorus Jack' possibly died of old age.

Professor GATES asked whether New Zealand waters were the natural home of Rossi's dolphin, or whether this animal had strayed from its usual habitat.

The New Zealand Glow-worm. By Dr. F. W. Edwards.

ONE of the most remarkable insects in the New Zealand fauna is the luminous larva which has long been known as the 'New Zealand Glow-worm'. Though widely distributed through both islands of New Zealand in suitable localities—damp ravines, crevices, tunnels, etc.—this larva has attracted most attention in certain localities where it lives in great numbers in caves. Of these caves the most famous are those at Waitomo, in the centre of the North Island, which are visited by many tourists. In the damper parts of the Waitomo caves, through which an underground river passes, the 'glow-worms' occur in immense numbers on the walls, roof, and stalactites, the myriad lights producing a scene of impressive beauty.

The 'New Zealand Glow-worm' is in no way related to the glow-worms of Europe, but is a Dipterous larva. The adult insect was first reared many years ago by Mr. G. V. Hudson of Wellington, who has recently re-investigated the life-history of the insect and published an account of it* in which he supplements his own early account as well as that of Norris†. Further observations (as yet unpublished) were made by Mr. A. L. Tonnoir (now of Canberra) when at Canterbury a few years ago.

From the accounts of these observers the following summary is compiled:—

The larva forms a web of fine threads, to which it adds globules of hygroscopic glutinous matter. It glides to and fro within a strong tube-like central mucilaginous thread, from which it can easily pass to any part of the web. From the web numerous loose threads hang down, and are provided

* Hudson, G. V., *Ann. & Mag. Nat. Hist.* (9) xvii, p. 228, and xviii, p. 667 (1926).

† *Ent. Monthly Mag.* (2) v, p. 202 (1894).

with sticky globules at distances of 2-3 mm., thus appearing like strings of beads. Regarding these threads Tonnoir states (in litt.), 'I have counted as many as fifty threads hanging from one glow-worm web, and in the caves they are about 5 inches to 1 foot long, and some can reach up to several feet. In other places where exposed to wind they never reach but a few centimeters'.

The luminous organ is situated in the terminal abdominal segment of the larva, and the production of light is under the control of the insect. According to Hudson the larvae shine most brilliantly on dark damp nights, and the light is brightest just before daybreak. They cease to shine on cold nights, and are very susceptible to vibrations of the air; it is said that in the caves even the vibrations due to talking will cause the larvae to put out their lights. The structure of the photogenic organ has been investigated by Wheeler and Williams*, who found it to be formed of the swollen ends of the four Malpighian tubules, which lie close together just ventral to the rectum, and are embedded in a 'reflector' made up of tracheal epithelium (not derived from the fat-body).

The food of the larvae has been found to consist largely if not entirely of small insects caught in the webs, and it seems clear that the function of the hanging threads is to act as 'fishing-lines', and that of the light to attract the prey. When a small fly is caught on one of the hanging threads, the thread is 'withdrawn slowly by a twisting movement of the anterior part of the body as if it were winding the thread round its thorax'. The prey is actually eaten (not merely sucked dry) by the larva. The prey taken appears to be mainly small Diptera, in the caves almost entirely Chironomid midges which hatch out from the water below. (A photograph reproduced by the New Zealand Government Tourist Department, showing a Geometrid moth on one of the threads, is a fake.)

The prey is rendered powerless on coming into contact with the viscous globules on the threads, but whether this is due to the physical or chemical properties of the liquid has not yet been ascertained. In view of the recent work of Mansbridge† on the biology of the British Ceroplatinae and Macrocerinae, it seems very probable that the fluid of the globules will be found to contain oxalic acid in sufficient concentration to be lethal to the prey of the 'glow-worm'.

The larva does not form any cocoon, the pupa being merely slung in the web by a few strong threads, which, though

* Wheeler and Williams, 'Psyche', xxii, p. 36 (1915).

† Mansbridge, G. H., Trans. R. Ent. Soc. London, lxxxi, p. 75 (1933).

merely part of the larval web, may, on drying, appear to be part of the pupa itself (as was thought by Hudson). Before pupation all the hanging threads have disappeared from the web (so that the pupa, as well as the adult when it emerges, is not liable to contact with the viscous and probably poisonous droplets). The pupa, like the larva, is luminous at the tip of the abdomen; 'they can put their lights on or off at will; sometimes the light is just as strong as that of the worms' (*Tonnoir*). The adult female is also luminous for at least

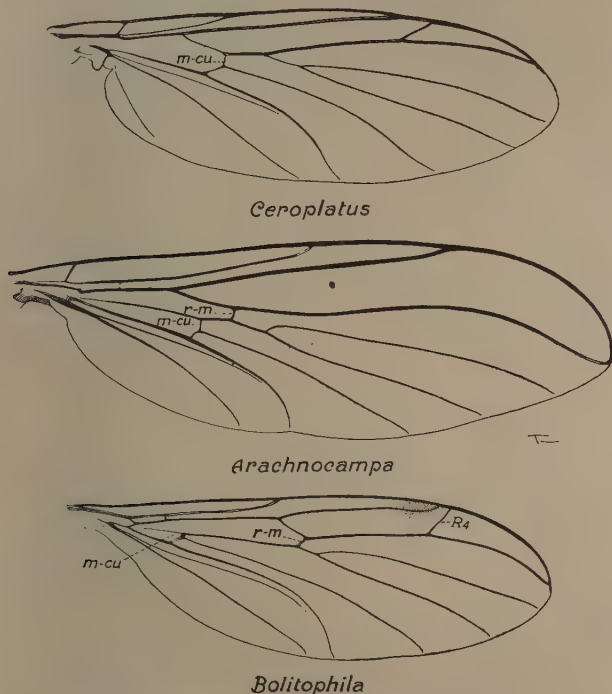


Fig. 1.—Wing-venation of the genera *Arachnocampa*, *Bolitophila*, and *Ceroplatus*.

two days after emergence, but the male is not so. Hudson thought that the light produced by the female might serve as an attraction to the male, but experiments he made to ascertain if this were so gave entirely negative results. It would not appear that the light produced by the pupa and imago is of any definite importance to the species.

The 'New Zealand Glow-Worm' belongs to the Dipterous family Mycetophilidae, but its precise relationships have been the subject of much doubt. It was first described by Skuse as *Bolitophila luminosa*, the resemblances in the venation of the adult wings being considered sufficiently close to justify the inclusion of the New Zealand insect in the European genus *Bolitophila*. However, the form and habits of the larva

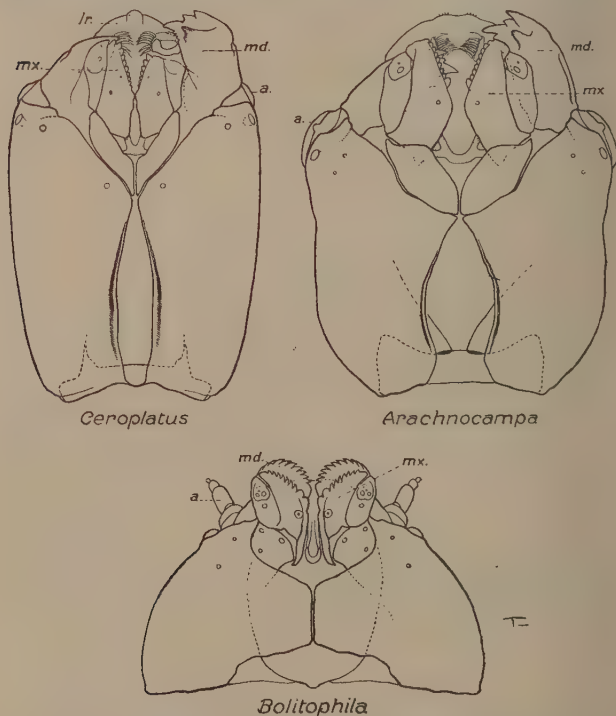


Fig. 2.—Heads of larvae (seen from beneath) of the genera *Arachnocampa*, *Bolitophila*, and *Ceroplatus*.

a., antenna; lr., labrum; md., mandible; mx., maxilla.

of *B. luminosa* are much more in accordance with those of the genus *Ceroplatus* (belonging to a different subfamily), and on this account I proposed* to transfer the New Zealand insect to a new genus *Arachnocampa*, the name being chosen to signify the spider-like habits of the larvae.

The classification of the Mycetophilidae has usually been

* Edwards, F. W., Ann. & Mag. Nat. Hist. (9) xiv, p. 175 (1924).

based mainly on the venation of the wings, the subfamilies Bolitophilinae and Ceroplastinae both being among those in which a cross-vein ($m-cu$) or fusion connects the median and cubital veins, the Bolitophilinae possessing also a distinct radio-median cross-vein ($r-m$), whereas in the Ceroplastinae the radius and media are fused for some distance, the median fork appearing to arrive from the radius. The difference is sufficiently striking, and as will be seen from the accompanying figure (fig. 1, p. 5), the wing of *Arachnocampa* is much more like that of *Bolitophila* than it is that of *Ceroplastus* (the absence of the short vein R_4 in *Arachnocampa* is of no special importance). In addition to the wing-venation there are other points in which the adult *Arachnocampa* appears to show more resemblance to *Bolitophila* than to *Ceroplastus*, such as the shape of the thorax, short tibial spurs, and absence of combs at the tip of the hind tibiae. Accordingly, Tonnoir and myself, in our revision of the New Zealand fungus-gnats*, were still inclined to place *Arachnocampa* in the Bolitophilinae, in spite of the known divergence in larval structure and habits. However, the final conclusion on the matter was left in doubt, as the structure of the head of the larva of *Arachnocampa* had not been examined. The opportunity has now been taken to investigate the structure of the head capsule and mouth-parts in the three genera (see fig. 2), and a brief statement is given below of some of the salient features of the three genera involved:—

*Comparison of larval and pupal characters of
Arachnocampa, Ceroplastus, and Bolitophila.*

Arachnocampa and *Ceroplastus*.

1. Larva forms a web of fine threads, on which it places droplets of hygroscopic liquid from the mouth; moves rapidly in a mucilaginous tube in the centre of the web.

2. Food of larva consists of insects caught in the web, or partly (*Ceroplastus*) of spores of fungi.

3. Body of larva very long, worm-like.

4. Head completely retractile into the thorax.

5. Head-capsule as long as or longer than broad, and pale in colour; with a very deep excavation beneath; posterior margin of epicranial plates indented.

Bolitophila.

1. Larva forms no web; lives in the interior of fungi growing on the ground.

2. Food of larva consists of the substance of the fungus in which it lives.

3. Body much shorter.

4. Head not retractile.

5. Head-capsule broader than long, blackish; with a shallow emargination beneath; posterior margin of epicranial plates not indented.

* Tonnoir, R. L., & Edwards, F. W., Trans. N.Z. Inst. lvii, p. 747 (1926).

Arachnocampa and *Ceroplatus*.

6. Labrum forming a prominent hood, with a ring-like chitinization at its base which is practically free from the clypeus.

7. Mandibles longer than broad, with about four large terminal teeth, one of which is somewhat removed from the others.

8. Antenna absent, being represented by a circular membranous area.

9. No functional spiracles.

10. Skin of abdomen transversely ridged (about 6-8 ridges on each segment, corresponding with bands of hypodermal pigment-cells).

11. Terminal segment distensible and provided with a pair of papillae.

12. Malpighian tubules more or less swollen apically, and in intimate connection with rectum.

13. Pupation takes place in the larval web.

14. Pupa inactive.

Bolitophila.

6. Labrum not hood-like, small, its basal chitinization attached to clypeus.

7. Mandibles almost semicircular, with a row of about ten teeth round front edge.

8. Antenna well-developed and segmented.

9. Large functional spiracles on prothorax and on each of first seven abdominal segments.

10. Skin of abdomen without transverse ridges; no hypodermal pigment-cells.

11. Terminal segment not specially distensible and without papillae.

12. Malpighian tubules not swollen apically and less intimately connected with rectum.

13. Pupation takes place in the ground.

14. Pupa active, wriggling to surface for ecdysis.

As a result of this study it has become clear that the resemblances between the larvae of *Arachnocampa* and *Ceroplatus* are even closer and more profound than had been supposed, and it is no longer possible to doubt that the two genera are closely related to one another, but only very distantly related to *Bolitophila*.

It is evident that we have here another example in which the larval characters are more important for classification than those of the adult, and that the adult characters on which reliance had been placed for classification are unreliable, and merely indicate superficial resemblance. No doubt, as in other similar instances, other adult characters exist which give a classification in harmony with natural affinities as indicated by the morphology and habits of the larvae.

The New Zealand species is not the only member of the genus *Arachnocampa* known, a second one having been discovered by the late A. M. Lea in the Ida Bay Caves in Tasmania and described by Ferguson*. The larvae of the Tasmanian species were found 'sparkling in crowds', in total darkness, fully a quarter of a mile from the entrance of the cave. Very recently similar larvae, possibly belonging to the same species as those of Tasmania, have been found in the Blue Mountains,

* Ferguson, E. W., Proc. Linn. Soc. N.S.W. 1, p. 487 (1925).

New South Wales, by Prof. A. Z. Nicholson of Sydney. (Prof. Nicholson very kindly sent for exhibition some beautiful photographic lantern-slides showing these larvae in their natural surroundings.)

In view of the conclusion expressed above as to the relationship of *Arachnocampa* with *Ceroplatus*, it is of interest to remark that this latter genus provides the only other known examples among the Diptera of truly luminous larvae (as distinct from sporadic instances in which the luminosity is due to the presence of photogenic bacteria in the food or surroundings of the larva). *Ceroplatus testaceus* has recently been investigated by Stammer*, who finds that this larva has no special luminous organ, the light proceeding from the whole larva and being formed in all parts of the fat-body; the production of light is apparently not under the control of the larva, and Stammer thinks that it has no biological significance, but must be regarded as merely a by-product of metabolism. *Ceroplatus testaceus* occurs in Britain, and observations on the luminosity of the larva (unfortunately never published) were made in the New Forest by the late Dr. D. Sharp. Not all larvae of *Ceroplatus* are luminous, but the phenomenon has been observed in *C. sesioides* Wahlb. in Europe and in *C. mastersi* Skuse in Australia.

In thanking Dr. Edwards for his interesting communication, the PRESIDENT asked whether the light emitted by the glow-worms attracted the mosquitos, on which the glow-worms fed.

Mr. J. RAMSBOTTOM commented on the difference shown in the examples mentioned by Dr. Edwards and the luminosity of various fungi where in different species different parts are luminous. Work during the past twenty years had shown that luminosity in animals was often due to the occurrence of a 'symbiotic' luminous bacterium.

Dr. STANLEY KEMP remarked that though various groups of animals in the deep sea had succeeded in evolving luminous organs, cave dwelling animals, in spite of a large number of special adaptations, had not been able to do so. The Dipteron of which Dr. Edwards had given such interesting details was not an exception to this statement. The species also lived outside, but had evidently found a specially favourable environment in the caves at Waitomo.

Dr. W. T. CALMAN commented on the fact that the luminous organ was connected with the Malpighian tubules, and mentioned two instances among marine Crustacea in which luminosity was associated with the organs of nitrogenous excretion.

* Stammer, H. J., Zeitschr. Morph. Oekol. Tiere, xxvi, p. 137 (1932).

Mr. A. J. WILMOTT asked whether it were certain that the light was put out by the insect, or whether it were possible that the luminous organ was withdrawn into the body.

Dr. EDWARDS replied that the light was definitely put out, as it showed through the body when the organ was withdrawn.

**C. H. Persoon and James E. Smith.
By Mr. J. Ramsbottom, O.B.E., Sec.L.S.**

CHRISTIAAN HENDRIK PERSOON (1761–1836) is a name which stands high amongst mycologists. Until a few years ago there was a sort of derived interest in him, as it was believed that his father was a Boer and his mother a Hottentot. The story gained currency from an obituary notice by Fée (Giorn. Bot. Ital. ii, 3, pp. (69)–(76), 1846; Bull. Soc. Roy. Bot. de Belgique, xxx, 2, 50–60, 1891). It was not until L. Verwoerd (C. G. Lloyd's 'Mycological Notes', viii, 1301, 1924) examined the Cape Archives that this myth was exploded, for it was found that Persoon's father was a comparatively well-to-do German settler, and his mother was the daughter of a Dutch burgher. Moreover, he was born on December 31st, 1761, and died on November 16th, 1836, whereas Fée gives the dates 1755–1837.

Some time ago, when trying to trace the origin of a number of miscellaneous fungi and lichens which had been transferred to the British Museum in 1893, my attention was called by Mr. Savage to a further small collection of fungi. These were together with a letter (in Latin) from Persoon, dated Göttingen, September 16th, 1794, in which he states that they were described in an accompanying paper from Römer's 'Neues Magazin für die Botanik'. He offers a paper for the Linnean Transactions. He states that he is concerned with the synonymy of fungi, and asks for twenty-two specimens of fungi (or at least bits of them) described by Linnaeus.

Persoon's paper in Römer's 'Neues Magazin' is entitled 'Neuer Versuch einer systematischen Eintheilung der Schwämme', the systematic portion of which is 'Dispositio Methodica Fungorum'.

The specimens which he forwarded are :—

Clavaria viscosa Pers. (*Clavaria fastigiata* L.??) in

Röm. Neues Mag. f. Bot. p. 117.

Corticium polygonium Pers., p. 110.

Geastrum rufescens Pers., p. 86.

Geoglossum hirsutum Pers., p. 117.

— *viride* Pers., p. 117.

Isaria agaricina Pers., p. 121.

Mitula Heyderi Pers., p. 116.

Peziza prunastri Pers., p. 115.

— *ribesia* Pers., p. 115.

Puccinia Circaeae Pers., p. 119.

Puccinia mucronata Pers. α *Rosae*, p. 118.

Ramaria fimbriata (*Clavaria byssiseda* mihi), p. 117, as

Clavaria fimbriata Pers.

Sphaeria cohaerens Pers., p. 82.

— *decolorans* Pers., p. 83.

— *Xylostii* Pers., p. 84.

— *rubiformis* (var. *a* and *b*) Pers., p. 82.

Other specimens are :—

Sphaeria graminis Pers., *Observationes mycologicae*, i, (1796), p. 18.

Sphaeria punctiformis Pers., in *Usteri Annalen der Botanik*, xi (1794), p. 26.

Sphaeria Pustula Pers., loc. cit.

— *ribesia* Pers. (as *S. ribesum*), tom. cit. p. 24.

There is also a specimen of *Polyporus perennis* labelled ‘*Boletus perennis* Lin.?’ One of the Linnean specimens asked for in the letter is this species.

There are an additional eleven letters, dating from 1795 to 1818, in the Smithian correspondence, though none of them is included in Lady Smith’s ‘*Memoirs and Correspondence of J. E. Smith*’. The first of these letters is in English, and dated December 22nd, 1795 :—

‘I took [the] liberty to answer Your friendly letter by a favourable opportunity immediately after I was so happy to get it last summer-season by kindness of Mr. Duncan.

‘In consequence of Your benevolent exertion and according to my wishes I would not have failed to send a short treatise for the third part of the Linnean Transactions, if I had not been impeded by the publication of the first part of mycological Observations—I shall have the honour to transmit in short—and besides by an ensuing indisposition.

‘Out of the same reason I send now only drawings belonging to that treatise, much time being wanted for their etching and illumination. Nothing will be more pleasing to me, than a soon advice, at what time I am to send over the Text.’ He encloses advertisements for Hedwig’s ‘*Theoria generationis*’.

The next letter, in Latin, is dated June 20th, 1796. He asks about the fate of his proposed paper on fungi, of which he had sent the drawings. He also asks for any plant which Smith may be able to send him from a list of fifty which he encloses, and asks him for a list of his desiderata, especially in Cryptogams.

A letter dated March 28th, 1798, is in English. He thanks Smith for a recent letter ‘full of real proofs of Your inestimable favour.

‘I wait desirously for the Diploma from the illustrious Linnean Society, so useful for Botanic, . . . I have the honour

to send hereby a treatise concerning the description of some new fungi. I wish You may not think them quite unworthy of being inserted into the fourth volume of the most valuable Transactions of the Linnean Society. But, not knowing for certain of which kinds delineated therein, I have sent You pictures, happening long time since, I beg most kindly, to impart me, as soon as possible the impressions of copper-plates, whereon they are etched, for dispatching after that the explanations of cuts.' He entreats also for a couple of reprints as he is to adopt the species in his 'Synopsis fungorum'. He asks for a 'copy' of the remarkable *Lycoperdon Phalloides* 'delineated by you'.

'I beg for my best service to Mr. Bracy Clark, and Mr Dickson who, God knows for what reason, has not yet replied to me; I am very much desiring of getting from him some cryptogamic plants in exchange.' A postscript to the letter reads:— 'That You may not have too high an opinion of my abilities in the english Language, not liking to lay claim to something I am not master off, I confess to have taken for my assistance in performing this and last letter, a connoisseur of english language.'

A note by Smith says:—'Ans^d. from Londⁿ. Apr. 17. I return 5 of his drawings to be named—6 others I easily refer to their descript^{ns}. Your paper cannot be *printed* in time for our 4th vol., but will be in the 5th . . . Will send you dried plants, & if possible *Lycoperdon phalloides*—have you coliforme ?'

The fourth letter is dated December 20th, 1798. It states that an illustrated account of a peculiar variety of Beech is sent for the Transactions:—'You are allowed, in case You should meet with something contrary, or not quite convenient, to the genius of english Idiom, to alter and mend it. Having been judged, conformably to the contents of some of Your valuable letters, not unworthy to become fellow of Linnean Society, and likewise promised by Your kindness to get deliver'd the Diploma of that honouring; I have, in expectation, to see Your kind promise accomplished, declared my self before hand, Fellow of that illustrious Society, upon my newest publication, some of following parts I shall take myself the honour to dedicate to Your celebrious name. I am in hopes to have put in compromise, by such behaviour of mine, neither me, nor the Society.' This is referred to again in the next letter, dated June 27th, 1799:—'In my letter above mentioned, I have explained myselfs about a concern of honour, I might not repeat here.'* The letter and paper had apparently been dispatched 'by the ordinary Dutch-

* Persoon was elected Foreign Member of the Linnean Society on July 16th, 1799.

quarter-Courier to Mr. Sowerby . . . agreeing to my proposal and his wishes, all my own publications till to this date and some small kinds of Fungusses in nature. I wish, You may tell him, in case he should not have got my paquet, I would send anew the desired books. In the very letter I was to mention You before hand, I should enjoy the honour to dedicate to your celebrious Name the *second part* of my *Mycological observations*, but that part is not yet done by carelessness of the printer . . .

'The Dissertations of Thunberg, defended at Upsala, are reprinted at this place under my inspection.' On June 19th, 1800, he sends the 'Dedication-Exemplar' apologizing for 'several printing faults' and the fact that the copy was on common paper. He expresses his pleasure at receiving the species of *Persoonia* and still asks for an answer 'about a certain point'.

On January 15th, 1801, he thanks Smith for his 'Flora britannica' etc. He asks for a copy of the 'Flora lapponica' 'this important work of Linnaeus not being to be got here, and I perhaps shall undertake next summer a botanical journey to Sweden and to a part of Lappland, where I shall want it . . . I beg you to burn my *Treaty on the fungi* as the described species in it are already made mention of in my *Synopsis*.' He makes requests from Smith, Turner, Francis, and Sowerby for rare plants 'for a *cryptogamical Manual*, which I wish now to elaborate, and which at present by the greater inclination of the Botanists for this study seemed to me not unnecessary'.

This letter also contains the following paragraph:—'The second volume of *Thunberg's Dissert. academ.* together with the *Copperplates*, wanting to the 1st. Vol. already in Your possession, I have send to Mr Sowerby by Dr *Bouttayt*, at present in London. The 3th Vol. I have send you before Christmass with the Hannoverian Messenger to Mr Best. To which I joined also that was ready of my *Synopsis fungorum*. The rest with Title and Preface comes after Easter. I believe to show You thereby my gratitude and esteem, whilst you are pleased to set some value on my mycological essays. Perhaps the name of *Bungea*, a generical name for the *Lycoperdon Phalloides*, will not please you, no more so yet to me; that of *Batarrea* might be preferable?'

It is necessary to consider what is here implied because '1801 (Persoon, *Synopsis methodica Fungorum*)' is the starting point for the nomenclature of Uredinales, Ustilaginales, and Gasteromycetes.

It is obvious from the letter that Smith received some pages of the 'Synopsis' before Christmas, i.e. 1800. Were these pages published?

The 'Synopsis' was published in two parts, but all copies

I have seen except one of the two in the Linnean Society's library are in one volume often with a specific index by D. G. H. L. The pagination is continuous, Pars prima being

BVNGEA.

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Lycoperdon aestium, subglobosum solidum, glabrum, subterraneum, radice destitutum, (ex pallido nigrescens). v. *Wulf. in Jacq. Coll.* 1. p. 344.

Magnitudo nucis castaneae est, primo sordide album, dein dilute fuscescens, tandem nigricans, laeue aut squamulas furfuraceas exhibet, apice terra subdennatum. *Radices* aut nullae aut capillares, fibrillosae. *Caro* spongiosa, primo alba, dein cinerascens, aut fuscescens, maturitate aut exsiccata celluloso-porosa. *Odor* subnullus; *sapor* nullus; apud multos tamen edule. *Wulfen*.

ORDO TERTIVS.

†. TRICHOSPERMAE. Pulvere seminali filis intertexto.

13. BVNGEA. Voluata, stipitata. *Pileus* deflexus, campanulatus, villosus, *pulveris strato* obsitus, a volua calyptratus.

1. BVNGEA PHALLOIDES: fuscescens.

Lycoperdon phalloides, voluatum; stipitatum, pileo deflexo campanulato supra
I pulue-

Fig. 1.

pages 1-240 and Pars secunda pages 241-706, with two pages of an Index Generum. Pages i-xxx include a Preface dated 'Mense Martii 1801', a *Conspectus systematicus, Explicatis*

iconum, and four pages of *Addenda et Corrigenda*. Both parts are dated 1801, and the introduction is to the whole work. (The specific index is dated 1808, and is by Georg Heinrich

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BUNGEE.

puluerulento calyptrato, infra glabro libero. *Dicks. Pl. crypt. Brit. Fasc. 1. p. 24. Woodward in Act. angl. v. 74. p. 425. t. 16.*

Lycoperdon Phalloides, volva subterranea radicata triplici, stipite centrali, parietem internum puluerulentum cum portione extimorum eleuante. *Smith. Spicileg. bot. Fasc. 1. p. 11. t. 12.*

Hab. in aggeribus arenosis in Anglia prope *Norwich* *Norfolciae* et *Bungay Suffolciae*

Volva ouata, bicorticata, albida, mucilagine repleta, sub terra ad vnc. 7—8 recondita. *Stipes* altitudine circiter pedali, cortice lacerato strigosus. *Pileus* subtus glaber, margine a stipite distante, superne tectus strato pulueris crassi, qui portione *voluae* disruptae quasi calyptra operitur. *Calyptra* lacerata libera. *Pulvis* fuscus. *Dickson.*

Totus fungus magis vel minus fuscescit. *Stipes* cylindricus, rectus, carnosus, mucilagine repletus, brevis, postea vero mira vi atque celeritate sursum elongatur. *Smith. l. c.*

Obs. Memorabilis hic fungus ob pileum (voluam intimam a *Smithio* denominatam), et voluam veram a ceteris *Lycoperdis*

Fig. 2.

Luenemann. An English edition of this was published by T. I. M. Forster in 1819, see *Trans. Brit. Mycol. Soc.* xviii, pp. 187–8 (1933).)

I have examined several copies of the work, but have found

no reason for believing that it was not published as a whole in 1801, the two parts appearing together *. Persoon's English is not of the clearest, but I understand him to mean that he had sent to Smith a copy of the pages which had been printed off, or were ready for this. It would be unlikely that he would publish any portion without a title-page. Further, his remarks about *Bungea* suggest that publication had not been effected. Smith was very likely to be interested in this proposed new genus, as he himself had written an account of the rare and remarkable *Lycoperdon phalloides* (*Spicilegium Botanicum*, i, t. 12, p. 12 (1792)). The proposed name is from Bungay, Suffolk, where it was first found by T. J. Woodward.

As everyone knows, the name *Batarrea* was given to this very characteristic Gasteromycete. As I read the facts, we need not concern ourselves with *Bungea* from a nomenclatural standpoint. It is, however, of interest bibliographically to find that Smith retained two cancelled leaves of the 'Synopsis'. His copy is the one referred to above as being in two volumes. This appears to be identical in every way with other copies except that Tabs. 1, 2, and 5 are missing, and that pp. 129-30 and 257-258 have the added cancelled pages. The first, headed 'Folium abrogatum curiosum', in Smith's writing, has the description of *Bungea*. (See figs. 1 & 2, pp. 14, 15.)

In the other page the Genus was wrongly numbered 41 instead of 42. There are several corrections, the most important of which are in the generic and sectional characters, which read :—

41 Agaricus. Evolvatus : Pileus varius, arescens. Lamellae inaequales, non liquescentes. Stipes annulatus, velatus, nudus.

Sectio Prima. Lepiota : stipite annulato. (Agaricus collinitus. Nonnulli Agarici Pratellae. Coprini.)

As presumably this cancelled leaf from Part II of the 'Synopsis' was received by Smith in 1800, it is additional evidence that the work was published as a whole.

Persoon states that he is likely to leave Göttingen the following spring, and the next letter is dated Paris, April 7th, 1802. In it he calls Smith 'mon très cher ami et protecteur'. He asks for forty-four specimens of Mosses, Liverworts, and Lichens determined according to Linnaeus's herbarium so as to be certain about the Linnean names. 'Je voudrais aussi savoir le caractère et la demeure de Mr. Goodenough pour lui envoyer des *Fuci* et des *conferves* en échange.'

* The pages of my own copy have not been trimmed. The title-page to Part II has printed at the bottom 'Dieser Titel wird vor pag. 241 gebunden'.

In his next letter, November 3rd, 1802, he promises a paper on new Mosses, Lichens, and Ferns if he is informed about 'the latest period, when You must have it'. He wants to know whether Sowerby continues 'his beautifull work on the english Fungi', and he again asks for his figures of fungi.

There follows a gap of eight years. A letter dated 12 Nov. 1810, complains that independently of the war, which puts a great obstacle to communication between the two countries, it is almost impossible for a foreigner to find the means of sending letters or any objects. He asks for news of botanical work in England, always so fertile in important discoveries.

He also asks whether he is mistaken in considering himself a foreign member of the Linnean Society as he had never received a diploma.

He wants to know whether Smith's Flora was completed—he had received Vols. 1 and 2 from Smith, and Vol. 3 in a pirated edition made at Zurich by Dr. Römer; whether Vol. VIII. of the Linnean Transactions had appeared—he had seen seven volumes 'chez un amateur'; whether Sowerby had continued his valuable work on the fungi of Great Britain—he had received up to Plate 259. He had seen from Robert Brown's 'Plants of New Holland', which had been sent to the French botanists at Paris—that his own 'Synopsis Plantarum' was known in England. In his spare time he was working at a complete 'Species Fungorum', and may add a cryptogamic portion to his 'Synopsis Plantarum'.

The last two letters are dated 1818 :—

Rue des Boulangers no. 4.,
Paris.

le 18 juin, 1818.

Monsieur,

En m'écrivant votre lettre amicale et flatteuse du 25 Mai, 1816, vous me dites avec cette bonté qui vous caractérise 'la correspondance m'accable, mais quand vous aurez quelque chose à me demander, écrivez, et je vous promets de repondre'.

Je n'ai pas voulu alors profiter de cette permission pour ne pas augmenter l'embarras de vos occupations et pour me réserver cet avantage pour une occasion urgente.

Permettez-moi, à present, de vous adresser cette lettre avec confidence, car je trouve un grand besoin d'épancher mon coeur dans celui d'un homme sensible. Souvent, on se trouve sans fautes, dans des circonstances défavorables, même malheureuses que l'on ne peut toujours ni prévoir ni maitriser. Depuis l'époque où le Cap de bonne espérance, ma patrie, est reconnu par les Traités avec le Roi des pays-bas, comme étant soumis à l'Angleterre, un particulier en Hollande, qui était alors en relation avec le Cap, et qui jusqu'à ce temps-là a pourvu à ma subsistance par des moyens pécuniaires ;

n'a pas voulu s'en charger d'avantage. Par augmentation de l'embarras, trois lettres que j'ai écrites à ma soeur, Madame van Rheenan, qui demeure à *Janzien Kraal* dans l'intérieur de colonie, sont restées, jusqu'à présent sans réponse, parcequ'elles ne sont pas, vraisemblablement, parvenues à leur adresse.

Vous sentez bien, Monsieur, dans quelle situation désagréable je me trouve maintenant par ses accidens, éloigné de mes parens et ne recevant d'eux aucune nouvelle depuis plusieurs années, je ne sais point ce qui me reste de mon héritage, car on n'a jamais m'en tenu compte*. N'ayant aucun emploi, je vive depuis fort retiré, car j'étois obligé de ménager ce qui me reste. La seule consolation me fait l'étude de plantes surtout de cryptogames au quel on peut se livrer dans le silence de cabinet. Je m'occupe depuis quelque temps d'un ouvrage assez étendu, d'une *Flora Cryptogamica*, dont le premier volume paraîtra chez le libraire Palm à Erlangen, vers le printemps prochain, mais, comme vous savez, on ne peut pas demander d'avance l'honoraire. La première édition de mon *Synopsis plantarum* est aussi épuisée, et l'éditeur désire en imprimer la seconde ; mais un travail qui demande tant d'application et de différente manière, où il faut consulter des herbiers et compulser et même posséder tant de livres, souvent très précieux, qui sont publiés depuis, surtout dans votre pays, est maintenant au dessus de mes forces ; car, indépendamment que ma santé n'est pas la meilleure, je dois auparavant être dégagé de toutes inquiétudes et des soucis pour une telle entreprise.

J'ose dire que j'ai fait quelque chose pour l'avancement de notre science, mais pour toute récompense, je n'en ai recueilli jusqu'à présent qu'une faible réputation, qui même actuellement m'est plus embarrassante qu'agréable.

Ainsi au fait, me considérant maintenant et par mon lieu natal et mes familles qui y demeurent, comme sujet de la Grande Bretagne, et je suis honoré de cette qualité, je m'adresse à vous, Monsieur, avec confiance et par nos anciennes liaisons littéraires, pour savoir, si dans la situation, ou je me trouve pour le moment, je pourrois recevoir des secours du Gouvernement Anglois ? Je voudrois pourtant les mériter par le fait ; et ce seroit ou par un emploi au Cap, comme naturaliste, quoique un voyage éloigné n'ait plus pour moi tant d'attraits qu'auparavant, ou de m'engager d'aller étudier et cueillir les objets d'histoire naturelle dans les isles anglaises de Jersey

* From Verwoerd's account it appears that Persoon at the age of twelve was sent to school at Lingen on the Ems, Germany. The following year his father died and left him 2,000 Dutch florins on condition that he continued his studies. As he and his two sisters were minors they became wards of the Board of Orphan Masters at the Cape of Good Hope.

et Gernesay, car outre que je resterai alors en communication directe avec l'Europe savante, je pourrais vous être de quelque utilité en y observant et vous adressant spécialement les productions végétales pour compléter autant que possible votre très intéressante Flore de la grand Bretagne.

Quoique vous demeuriez éloigné de la Capitale, cependant par votre grande réputation et par votre crédit auprès des personnes de marque et d'influence, vous pourrez, Monsieur, si non réaliser ce projet, du moins en faciliter la réussite en m'indiquant le moyen d'y parvenir. Je comprends aussi, comme je n'ai jamais été en Angleterre, et étant par cette raison inconnu par des gens en place, il y aura de la difficulté de réussir, du moins promptement; et dans ce cas, je ferai volontiers le sacrifice de mon Herbarium (continent plus ou moins 14 milles plantes) en *totalité* ou en *partie*, par exemple, quant à cette dernière, d'une collection de plantes d'Europe, surtout de plantes cryptogames en bon état et bien déterminées, dont j'indiquerai une autre fois le nombre et le prix, et pour laquelle il se trouvera probablement par votre recommandation, un amateur parmi vos connoissances.

Par une sorte de délicatesse, je vous prie de ne point parler de cette affaire à des personnes auxquelles elle n'appartiendra absolument. Et quelque soit le résultat de votre intercession en ma faveur, je regarderai, Monsieur, comme une preuve de votre bienveillance et de votre amitié, si vous voulez bien m'honorer d'une prompte réponse.

Veuillez, au reste, agréer l'assurance de ma parfaite considération et de mon dévouement.

C. H. PERSOON.

P.S.—Vous trouverez ci-joint les fragmens de deux Fougères dont je desire savoir si l'un appartient à votre *Polypodium calcareum* et l'autre au *Aspidium lobatum*. Ces espèces sont indigènes de la France: la première se trouve aux environs de Paris, et la seconde croît en Bretagne.

Paris.

le 18 juillet, 1818.

Je vous prie, Monsieur, d'agréer mes remerciements pour votre prompte réponse et de bons conseils qu'elle renfermoit, ainsi que de me passer les importunités que j'étois, par des circonstances, forcé de vous faire par ma lettre, et de vous écrire encore celle-ci mais qui sera d'une nature plus calme.

J'avois aussi l'intention de m'adresser au respectable Sir Joseph Banks, mais vu son grand age et les infirmités physiques qu'en sont la suite, je n'ai pas voulu lui occasioner la peine de s'occuper de mes affaires, quoique je pusse me flatter qu'il n'en sera pas insensible. Peut être, vous ferez,

Monsieur, l'automne prochain un voyage à Londres, et je vous prie alors de lui en parler, et si je sais par votre réponse l'intention de Monsieur Banks, je prendrai la liberté de lui écrire.

Le Gouvernement Hollandois pourroit bien m'accorder une pension, comme celà a lieu dans plusieurs pays à l'égard des savants, ou autres hommes de mérite, non seulement comme son ancien sujet, mais étant le seul du Cap de bonne Espérance, autant que je le sache, qui s'est fait connoître par des ouvrages qui aient été de quelque avantage pour la science ; mais pour ce but, il faut avoir de protection ou une recommandation puissante.

N'étant plus jeune, ni d'une forte santé, affoiblie par des travaux et surtout des chagrins, et ayant fait beaucoup de courses pour recueillir des matériaux pour mes ouvrages, surtout mycologiques, je sens maintenant le besoin pour le repos et d'employer mon temps et le peu d'années peut-être qui me restent encore à vivre, d'achever les ouvrages que j'ai commencés ; ou d'en publier des nouvelles éditions en cas de nécessité.

Par ces causes et ces motifs, je crois devoir vous prévenir et en vous remerciant sincèrement de votre bonne volonté, de ne pas vous donner la peine d'engager un riche amateur de m'envoyer quelque part, surtout dans un pays très éloigné même au Cap, dans le dessein d'y chercher et d'observer des plantes et autres objets d'histoire naturelle ; un tel emploi convient mieux à un jeune homme qui est dans la force de son âge et qui veut en même temps s'instruire.

Il faut que je vous rapporte aussi, Monsieur, quelques bonnes nouvelles. Quelques jours après l'arrivée de votre lettre, j'en ai reçu de mes soeurs. J'avois cru l'ainée comme n'étant plus parmi les vivants, n'ayant reçu d'elle aucune lettre depuis plusieurs années. Ma soeur qui étoit mariée à Jacq. van Rheenen, connu aussi en Londres par la relation de son voyage (traduite dans votre langue) qu'il avoit entrepris pour découvrir et assister les naufragés anglois du Vaisseau le Grosvenor, elle demeure, dis-je, maintenant dans le ville de Cap. Sa reponse, que j'attendrois depuis 3 ans, a été confiée à M. Rheinwardt, commissaire du Gouvernement des Pays-bas pour les Grandes Indes, ne m'est point parvenue.

Ce n'étoit pas la seule fatalité d'éloignement de mon pays natal, car j'ai aussis appris que l'on croit au Cap que les capitaux de mon héritage, qui, après ma majorité même, sont restés à la maison d'orphelins ou *Weeskamer* en hollandois, n'ont point donné des rentes et que l'on a pris du capital l'argent nécessaire pour mon entretien en Europe, de sorte qui ne m'en reste pas à présent beaucoup et dont je ne pourrai vivre dans l'avenir sans une autre ressource de revenu.

Quoiqu'il en soit, j'enverrai sous peu au Cap une procuration, afin de faire retirer du Weeskamer l'argent et autres effets qui m'appartiennent, dont la valeur en lettres de change arrivera, je l'espère, vers le printemps prochain.

Excusez moi, Monsieur, je vous prie, de vous avoir entretenu de tous ses détails, qui n'ont pour vu en soi aucun intérêt ; mais comme vous m'avez bien voulu me temoigner surtout dans votre dernière lettre, de l'amitié, j'ai cru pouvoir vous en faire part. Vu vos occupations et votre voyage que vous vous proposez de faire à Liverpool, veuillez seulement m'écrire quand vous aurez des nouvelles agréables à je mander. Au reste, j'ai l'honneur d'être avec considération et devouement votre très-humble Serviteur

C. H. PERSOON.

Fée states that he met Persoon in Paris, and, struck with his poverty, obtained subscriptions from several botanists, but Persoon refused to accept the money without making some return. Fée got into touch with Dr. Kirckhoff of Antwerp, and suggested that he should propose to the king that Persoon's herbarium should be purchased. Persoon was asked to draw up a statement about himself and his work, and this, which Fée publishes, is very similar to that contained in the last two letters to Smith.

'... il reçut un brevet d'une pension de 800 florins (1760 fr.). L'herbier partit alors pour Bruxelles et de là fut transporté à Leyde.'

The following paper was read in title :—The Rotifer fauna associated with the Phytoplankton of twenty-eight Lowland Waters. (Studies in the Phytoplankton of the Lowland Waters of Great Britain.—No. VI.) By Dr. B. M. GRIFFITHS and Mr. F. E. COCKS.

9 NOVEMBER 1933

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 26 October 1933, having been circulated, were taken as read, and confirmed.

The President reported the death of Lt.-Col. Edwin Harold Brown, Fellow of the Society.

The President announced that the Organizing Committee of the Sixth International Botanical Congress had decided to change the dates of the Congress at Amsterdam, Holland, to September 2nd to 7th, 1935.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

Mr. T. B. Blow gave a short account of a MS. 'Catalogue of plants observed near Hertford', by W. H. Coleman, dated 1839, presented to the Society by Miss P. Ransom.

According to Mr. J. E. Little the manuscript had been found by Mr. Joshua Lamb. Its existence was previously unknown. The three lines in uncial Greek script on the title page have been traced to Theocritus, Idyll XIII. lines 40-42, with a reference to four plants by name. The MS. appears to be a holograph by Coleman in a very neat scholarly hand written presumably with a carefully trimmed quill pen and with no trace of erasures.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted:—Doris Richardson, Edred John Henry Corner, and James Percy Tufnell Burchell, M.C.

Certificates of recommendation of the following candidates for Fellowship were read:—For the second time, in favour of Edith Dorothy Brain, Alexander Frank Fountain, Don Carlin Gunawardena, Robert John Aylwin Wallace Lever, Harold George Fisher MacDonald, Guy Walter Otter, Cyril Dean Darlington, and Frances Lotte Stephens; for the first time, in favour of John Francis George Wheeler, Bernard Dearman Burt, John Spedan Lewis, Raymond Henry Stoughton and Thomas Edward Wallis.

Exhibit of branches of the White-fruited Spindle tree.

By Mr. H. Stuart Thompson, A.L.S.

MR. STUART THOMPSON sent some fruiting branches of a White-fruited Spindle, *Euonymus europæus* L. which he had gathered at Croxbottom close to Bristol and in N. Somerset. It is the locality where it was first seen by Miss Roper in 1912 (see Journ. Bot. p. 377, 1912). The specimen differed from de Candolle's var. *leucocarpus*, as in the latter both the walls of the fruit and the arils are described as white, while in Mr. Thompson's specimen only the walls of the ovary were white, the arils being of the normal orange colour.

Exhibit of *Cladophora* balls from Ireland.

By Mr. A. D. Cotton.

MR. A. D. COTTON showed algal balls formed by the fresh-water species *Cladophora Sauteri* Kützinger, which were dredged in Lake Ballycullinan. Co. Clare, and ranged from one to five inches in diameter. In section the balls were seen to consist

of a solid mass of dark green filaments and showed zonation. The innermost filaments were living (as shown by plasmolysis), contained abundance of chlorophyll, and were packed with starch grains.

The PRESIDENT enquired what their rate of growth might be and what would be the approximate age of the largest ones exhibited?

Mr. D. J. SCOURFIELD said that his specimens of the Algal balls, which had been referred to by Mr. Cotton as an example of their longevity, came from the Norfolk Broads. One specimen which he had kept in a glass jar not much larger in diameter than the ball itself lived for about nine years, and during nearly the whole of that time it had remained quite healthy, although it did not increase in size to any appreciable extent. These floating *Cladophora* balls occasionally occurred in such great numbers in the Norfolk Broads district that they actually became troublesome to the wherry-men who fished them out with large nets. There was an interesting paper on these balls by Dr. Wesenberg-Lund ('Sur les *Aegagropila sauteri* du lac de Sorö', Oversigt over det Kgl. Danske Videnskabernes Selskabs Forhandlinger, 1903, no. 2).

An abnormal mushroom. (Exhibit.)

By Mr. J. Ramsbottom.

MR. J. RAMSBOTTOM commented on an abnormal mushroom found by Mr. H. E. FORREST, F.L.S., at Marrington Hall, on the borders of Shropshire and Montgomeryshire, and sent for exhibition.

The specimen showed two fruit-bodies of the common field mushroom (*Psalliota campestris*), the one growing from the cap of the other, the two caps being joined. The upper fungus, in spite of its reversed position, showed normal gills, ring, and stipe. Mr. Ramsbottom said that he had not previously seen an abnormality of this kind in which both portions had all parts perfect: Worthington G. Smith, however, described and figured (Gard. Chron. 1873, p. 1016, fig. 208 A) a specimen in which three fruit-bodies were joined, the second growing in a reversed manner from the cap of the first as in the present specimen, but with a third normally orientated cap growing from the inverted stipe.

Exhibit of a long-lived slow-worm. By Mr. H. N. Dixon.

MR. H. N. DIXON exhibited a specimen of a slow-worm, which had been captured by his sister in South Devon in 1905, and had been kept by her in a vivarium until the summer of this year, when it died. This specimen is referred to in Step's

'Animal Life of the British Isles', p. 145 (1921), as probably the oldest then known. Miss Dixon believes it to have been four or perhaps five years old when captured, which would bring its age to at least thirty-two at the time of death. It is probable that its death was not then entirely natural, as it had escaped and been re-captured a few months earlier, and since then (when it was quite healthy and in good condition) it had refused food and gradually wasted away.

**Note on the Rhizocephala in the collection of the
British Museum. By Dr. H. Boschma.**

THE extensive collection, brought together from many different regions of the world, consists of representatives of eighteen previously known species, eleven new species, and two lots of specimens of *Thompsonia*, which have not been named specifically. From a general point of view the most important specimens of the collection are the following :—

1. The type specimen of *Sacculina rotundata* Miers. In 1925 Van Kampen and Boschma regarded specimens from the material of the *Siboga* expedition as identical with *S. rotundata*, although Miers's figure of the excrescences of the external cuticle is rather incomplete and his description of the species is of a somewhat superficial kind. The remnants of the type specimen in the British Museum collection gave definite proof of this identity.

2. The type specimen of *Lernaeodiscus galathea* (Norman and Scott). In 1906 Norman and Scott used the name *Sacculina galathea* for the parasite which was mentioned by Smith (1906) under the name *Lernaeodiscus galathea*. In the library of the British Museum both of these publications are dated, so that it could be demonstrated without doubt that Norman and Scott's name has priority. Moreover, this specimen undoubtedly is a representative of the genus *Lernaeodiscus*, not a *Galatheascus* (see under 3).

3. One parasite of *Galathea intermedia* and one of *Galathea nexa* belong to the new species *Galatheascus minutus*, a Peltogastrid. The common parasite of these species of *Galathea* is *Lernaeodiscus galathea* mentioned above.

4. Perhaps the most interesting specimens of the collection are those of the new genus and new species *Ptychascus glaber*. This species in all particulars is like *Sacculina*, except for the fact that the mantle opening lies at the extremity of a long tube, which is directed to one side, and that the mantle bears septa, which form brood pouches, as in the Peltogastrid genus *Septosaccus*. A further difference between the two genera is that in *Sacculina* the larvae hatch as nauplii, in *Ptychascus* in the cypris stage. This protection of the brood in *Ptychascus* probably has arisen as a result of its living in fresh water :

the specimens were collected on Marajo Island in the mouth of the Amazon River. There are some other genera of Rhizocephala in which the larvae hatch in the cypris stage; these occur in the polar regions (*Chistosaccus* and *Sylon*), or in fresh water (*Sesarma xenos*). One of the species of *Sesarma xenos* has been described by Annandale from one of the Andaman Islands, another by Feuerborn from Java. We find here a phenomenon which can be observed also in other groups of animals, namely that protection of the brood occurs especially in arctic forms and in those living in fresh water. There is, however, one genus of Rhizocephala which is exceptional to this rule: the aberrant form *Thompsonia*, representatives of which also live in shallow water of tropical seas. In all the forms of this genus in which the larvae are known they hatch in the cypris stage.

5. As already mentioned the specimens of *Thompsonia* have not been named specifically. From the literature all the available data have been compiled in a list of the named and unnamed known specimens and their respective hosts. The parasites themselves do not afford sufficient characters for the establishment of well defined species.

Note on the results of the 'Snellius' Expedition.

By Dr. H. Bøsehma.

THE work of the *Snellius* Expedition was done between July 1929 and November 1930. The field of operation was the eastern half of the East Indian Archipelago, approximately the same region as that of the *Siboga* Expedition in 1899 and 1900. The work of the latter was almost completely confined to biological collecting, the *Snellius* Expedition was of an oceanographical kind, its chief object being the hydrology (temperature, salinity, oxygen content, and current measurements) of the different parts of the sea and the geology of the sea bottom and various islands. The biological work was almost completely restricted to the collecting of plankton (chiefly from the surface) and the collecting of animals from the shore and shallow water of different islands.

The track of the *Snellius* Expedition had a length of about 60,000 km., following in general a zigzag course across the deep basins between the islands and the subsurface ridges. Hydrological and geological investigations were carried out at 371 stations; moreover, by means of echo sounding apparatus about 32,000 data on the depth of the sea have been obtained.

Some of the most striking results in hydrology are the following:—

1. The deepest region investigated is the Emden deep near Mindanao. Here a bottom sample and hydrological data were obtained from a depth of more than 10,000 metres.

2. The minimum temperature of the different basins is markedly different owing to their being separated from each other by ridges of different height. The coldest water which can penetrate into these basins is that of a layer slightly above the top of these ridges. The higher the ridges bordering these basins the higher the minimum temperature of the water in these basins.

3. From the neighbouring oceans water of high salinity flows into the investigated area. The data of the surface water give more complicated results than those of the water at a depth of 150 m.; here, *e. g.*, a distinct current of water of high salinity can be plotted out, which originates in the Pacific, penetrates into the north-eastern part of the region, and divides into two separate currents, one going in a westerly, the other in a southerly direction.

4. The Kaoe Bay in Halmahera consists of a comparatively deep basin (500 m.), separated from the main sea by a high ridge (approximately 50 m. below the surface). In this bay the water is more or less stagnant, the oxygen content drops rapidly towards the bottom, so that at a depth of 400 m. there is no oxygen at all. From this depth down to the bottom there is an amount of H_2S , gradually increasing with the depth. The phenomena found here correspond closely with those occurring in the Black Sea and in some of the Norwegian fjords.

The notes given above must be regarded as remarks of a preliminary kind, as the scientific results of the expedition have not yet been published. They are beginning to appear now, and the report on the geology of coral reefs is in the press. Those on the hydrological, meteorological, and chemical results will follow soon afterwards. The results in biology will appear in 'Bijdragen tot de Dierkunde', separate from the other publications of the *Snellius* Expedition.

Dr. W. T. CALMAN expressed the indebtedness of the Natural History Museum to Dr. Boschma for the working out of this collection. He pointed out that the late Professor Giard's theory of 'phylogenetic parallelism' had had particularly unfortunate effects on the systematic study of Rhizocephala. Professor Giard had insisted on the specificity of the parasites to the extent of giving names to forms of which nothing was recorded beyond the names of their hosts. Later writers had gone to the other extreme, and had lumped together all the forms of *Sacculina* regardless of hosts and of locality. Dr. Boschma's investigations appeared to be providing solid ground for systematic discrimination, and were leading to a result in some respects intermediate between the views of Dr. Giard and those of his immediate successors.

Sir SIDNEY HARMER congratulated the Society on having heard Professor Boschma's interesting account of the extremely important investigations of the *Snellius*. In the course of his own study of the Reteporidae of the *Siboga* Expedition he had found curious anomalies in the distribution of this group in the Malay Archipelago. The Straits of Makassar and the Banda Sea differ markedly from all other parts of the Archipelago in the complete absence of Retepores in water deeper than 200 m., and in their very restricted number in shallower water. The great area of the Banda Sea produced only two Retepores out of 88 shallow water records of Polyzoa, and the Straits of Makassar only seven out of 219. He enquired whether the *Snellius* results might suggest any explanation of these facts, and particularly whether the rarity or absence of Retepores in certain areas might be connected with the occurrence of H_2S at the bottom.

Professor Max Weber had kindly called his attention to the results described by Böggild in Livr. 79 (1916) of the *Siboga* Reports. From these it appears that in all the deep basins of the Archipelago, $CaCO_3$ occurs in quantities much smaller than in the open oceans; and that it diminishes regularly with increase of depth, at first comparatively slowly, but afterwards much more rapidly. It seems probable that the want of sufficient $CaCO_3$ is a limiting factor in the occurrence of well calcified organisms; and some support is given to this idea by the fact that while Retepores were not found in deep dredgings in the Banda Sea, there are records here of abyssal Polyzoa of delicate habit and but slightly calcified.

The Vegetation of the Island of Rum.

By Mr. C. V. B. Marquand.

Of this island in the Inner Hebrides, which has an area of some forty-two square miles, nothing botanical was known previously.

After a brief outline of the geology of the island as it affects the vegetation, a preliminary general account of the vegetation and flora, from the sea coast to the summits of the highest mountains (Askival, 2659 ft.), was illustrated by lantern slides from infra-red and panchromatic photographs.

The floristic survey was primarily bryological, but note was taken of the phanerogamic flora on the Torridon sandstone, Gabbro and Basalt, and Granite areas which occupy respectively the North, South-east, and West parts of the island.

In an investigation of the lower zones Mr. J. B. Duncan, Dr. L. B. C. Trotter, Miss G. Wigglesworth, and Miss B. M. Sutton co-operated.

Comparisons were drawn with the Isle of Skye, the mainland of Scotland, and other areas.

The following are the new records for vice-county 104 :—

MUSCI.

- Tetraphis pellucida* Hedw.
Polytrichum juniperinum Willd.
Ditrichum flexicaule Hampe
Dicranoweisia cirrata Lindb.
Dicranum fuscescens Turn.
 ——— *Scottianum* Turn.
Fissideus osmundoides Hedw.
 ——— *decipiens* De Not.
 ——— *taxifolius* Hedw.
Grimmia maritima Smith
Trichostomum mutabile Bruch
 ——— ——— var. *littorale* Dixon
 ——— *tortuosum* Dixon
Funaria ericetorum Dixon
Bartramia pomiformis Hedw.
Webera albicans Schp.
Heterocladium heteropterum B. & S.
Brachythecium plumosum B. & S.
Eurhynchium pumilum Schp.
Plagiothecium denticulatum B. & S.
Hypnum stellatum Schreb.
 ——— *falcatum* Brid.
 ——— *callichroum* Brid.
 ——— *molluscum* Hedw. var. *condensatum* Schp.
 ——— *scorpioides* L.

HEPATICAE.

- Aplozia cordifolia* (Hook.) Dum.
Lophocolea cuspidata Limpr.
Cephalozia media Lindb.
Cephaloziella striatula (Jens.) Douin
Odontoschisma elongatum Evans
Radula Lindbergiana Gottsche

Of these *Odontoschisma elongatum* is perhaps the most interesting, as it is recorded from only four vice-countries.

On the bare mountains which are very similar to the Black Cuillin of Skye, *Arabis petraea* is frequent, but *A. alpina* was not seen. Nor was *Eriocaulon sexangulare* present in those of the lochans which were examined.

Mr. T. B. BLOW asked whether the *Lastraea spinulosa* mentioned was the species. Mr. Marquand replied that it was.

23 NOVEMBER 1933

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 9 November 1933, having been circulated, were taken as read and confirmed.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellow signed the Obligation in the Book of the Charter and Bye-Laws and was admitted :—Chrystabel Prudence Goldsmith Procter.

Certificates of recommendation of the following candidates for Fellowship were read :—For the second time, in favour of John Francis George Wheeler, Bernard Dearman Burt, John Spedan Lewis, Raymond Henry Stoughton and Thomas Edward Wallis; for the first time, in favour of Mahbub Alam, Hamish Boyd Gilliland and Valentine Jackson Chapman.

Exhibit of cushions of *Leucobryum glaucum* Schimp.

By Miss May Rathbone.

THE cushions of *Leucobryum glaucum* Schimp. came from beech woods near Chandlers Ford in Hampshire, where they are said to be common. Two were in process of formation and another formed a complete oval cushion, about 2 inches by $1\frac{1}{2}$ and nearly 1 inch thick, entirely green on both sides, with no soil or dead stems showing. The cushions seemed too heavy to be produced by the action of wind and Mr. Gepp, to whom they were shown, suggested that they might be produced by rabbits kicking up the moss and said that similar growths are found in Epping Forest. There is a note on 'Mosses as acting Tumble-Weeds' by Mr. Dixon in the Proc. Linn. Soc. for last year.

Dr. G. P. BIDDER enquired if there was any possibility of the moss-balls being rolled by wind, like the ellipsoidal aggregates of sea-weed and hydrozoan skeletons which are found rolling on smooth sands of the seashore?

A specimen of *Orchis mascula* L., with abnormal flowers.

By Dr. A. B. Rendle.

DR. RENDLE showed a specimen of *Orchis mascula* L. with abnormal flowers sent by Mr. Ronald Burn from West Suffolk. The structure of the flower was demonstrated by means of

lantern slides. The sepals and petals were much reduced in size, and the auricles on the column present in the normal flower were each replaced by a pair of imperfect pollen-sacs. The caudicles of the normally placed median pair of pollen-sacs terminated in the rostellum, but no glands were present. The small, deeply bilobed lip bore a small pollen-sac on each side below the lobe. The spur was only 1.5 mm. long. If we regard the pollen-sacs on the lip as representing the two lateral stamens of the outer whorl which are absent in the normal flower, the flower in question is pentandrous. The presence of the pollen-sacs on the lip is of interest in view of Darwin's hypothesis that the lip of the typical Orchid flower represents the union of the median petal with the lateral stamens of the outer whorl; according to Pfitzer, however, this view is not confirmed by study of the floral development.

Mr. W. C. WORSDELL said that the exhibit was very interesting. The abnormal flower probably represents a reversion to an ancestral condition. *O. mascula* was the first orchid in which double flowers were found, viz. by Jacob in 1778.

Mr. V. S. SUMMERHAYES (Visitor) stated that he had recently examined a flower of *Orchis maculata* L., in which the column was normal in construction, but each of the lateral petals bore a single anther theca containing a pollinium, but no gland. The sepals and labellum were normal in structure. The above abnormality showed that any of the inner perianth members might be antheriferous, and was therefore evidence against Darwin's theory of the nature of the lip.

Prof. J. R. MATTHEWS recalled his examination of somewhat similar triandrous flowers in *Orchis purpurea*, gathered in Kent in 1914. Anatomical study of these specimens led to the conclusion that the two extra fertile stamens were members of the outer whorl, and did not support the view that the labellum in the Orchid flower is a complex structure representing the fusion of the posterior petal and the pair of outer stamens.

Quantitative methods in the analysis of vegetation.

By Dr. Eric Ashby.

IN recent years there has been a gradual substitution of quantitative for qualitative methods in Biology, and Ecology has not escaped this tendency. The purpose of the present discussion is to enquire whether the use of quantitative methods in the analysis of vegetation throws more light upon associations than do older qualitative methods. Can, in fact, such units as moor, wood, and marsh, whose physiognomy is clearly defined, be expressed in quantitative terms?

(i.) Thirty-one years ago Jaccard applied quantitative methods to the comparison of the floras of alpine meadows in

different situations. The percentage of the total number of species in two areas which is common to both those areas was chosen as a unit of measurement. In two identical areas the percentage is 100. In two areas with no species in common the percentage is zero. Comparison of the floras of heather and cotton grass moor in Derbyshire gives a percentage of 22.9 (a low value); comparison of the shade species in ash and oak woods gives a percentage of 82. Since Jaccard's method does not take into account the relative abundance of species, it does not express the physiognomy of the vegetation adequately.

(ii.) The Uppsala school of ecologists use a method based on the 'frequency' determination of Raunkiaer. They lay a quadrat of standard size several times on the association to be studied, and classify the species into those which occur in 90 to 100 per cent. of the quadrats, 80 to 90 per cent., and so on. The association may then be defined as a plant community of certain characteristic species which occur with definite frequency in quadrats of fixed size.

This so-called statistical method presupposes a rigid numerical inter-relationship between the species composing an association. Such an inter-relationship does not exist in nature. Furthermore, the frequency, which is the probability of finding a species, has a *logarithmic* relation to the density of the species, so that frequencies are a very distorted measure of abundance, and generalisations based on frequency determinations are misleading.

In brief, no quantitative method used up to the present is of value for describing plant associations, and no improvement can be suggested upon the descriptive methods at present in use in this country.

Quantitative methods are available, however, for the investigation of the distribution of individual species in relation to the environment. A method based on correlations is being developed for studying competition between two species under different environment conditions. The differential effect of light upon the growth and competition of *Pteris* and *Calluna* has been successfully studied by this method.

A statistical study of the distribution of species in Grassland Associations. By Mr. G. E. Blackman.

ALTHOUGH a large number of papers have been published on the inter-relationship between species in an association, no detailed investigation has been made of the manner in which such species are distributed. Kylin and Wicksell, in calculating the relationship between quadrat size and the average number of species within the quadrat, assumed

that the distribution of each species was at random. On the other hand the work of Du Rietz and others on 'minimal area' and 'constant' species infers that the distribution was not random.

The present investigations were undertaken to determine in what manner species are distributed in grassland associations. The technique consisted in throwing down a quadrat a large number of times at random, and noting the species present at each throw. In addition, the number of individuals of each species in the quadrat was also counted, but with species where it was impossible to define an individual plant 'tiller counts' or estimates of the percentage area covered by the species were made.

Examination of the data showed that the frequency distribution curves were very similar in the great majority of species. Usually where individual plants were counted the distribution was at random, since the distribution curves were of the 'Poisson' type. With the 'tiller count' and 'area covered' data it was found that distribution curves of the binomial type gave good fits, the form of these curves approximating closely to the Poisson form.

If species in an association are distributed at random and the distribution is of the Poisson type then the determination of percentage frequency has many advantages. It is possible to calculate from a known percentage frequency the percentage frequency in any sized quadrat. In addition, the percentage frequency has a quantitative value, since the form of the Poisson distribution curve is dependent on the percentage number of quadrats containing no individuals of the species. It is therefore possible from changes in percentage frequency to estimate the fluctuation in the population of the species.

Dr. A. R. CLAPHAM :

Data collected from chalk grassland communities show that the individuals of a species tend to be clustered round parent plants or in favourable patches of soil; and if the percentages of small quadrats containing 0, 1, 2, 3, . . . individuals be compared with those calculated on the assumption of a random distribution of individuals, there is usually an excess in the zero class and in high classes, with a corresponding deficit of quadrats containing one or two individuals. These discrepancies become less marked with increasing density of the species or increasing size of the quadrat.

Quantitative data from plant communities are necessarily derived from samples, and their value depends upon their susceptibility to the statistical methods available. These methods involve at present the assumption that the individual values are distributed normally, i.e. in the symmetrical

frequency curve typical of the majority of biometrical data : the theoretical treatment of other kinds of distribution has been little developed. A moderate deviation from normality may lead to no seriously erroneous conclusions, but many of the experimental results gave distributions far beyond the limits of safety, the curves being much more skew than the corresponding Poisson distributions.

Data which can safely be handled by the usual methods can be obtained, however, by paying attention to two points. Firstly, the sampling units should be sufficiently large to include about half the species present in the area ; and, secondly, should be made more representative of the community by being narrowly rectangular rather than square. Representativeness can be further increased by dissection of the strip. Thus instead of a single strip 4 metres by $\frac{1}{4}$ metre, four strips each 1 metre by $\frac{1}{4}$ metre should form a composite sampling unit, the individual quarter strips being arranged in a cross with spaces separating their ends.

Dr. H. GODWIN (Visitor) also spoke.

Some quantitative methods for the analysis of insect associations. By Mr. O. W. Richards.

IN botanical studies, there is no great difficulty in counting the number of individuals and, apart from economic forestry, estimations of frequency are used to show the relative rather than the absolute numbers of the species.

In insects, there is a very great preliminary difficulty in attempting to estimate numbers at all. Again, the absolute numbers of animals vary so much from year to year that it is quite as necessary to discover the absolute as the relative frequencies.

The methods of estimating numbers must depend mainly upon the habits of the particular species. Wingless, terrestrial forms can be counted without great difficulty, but special methods are needed for any active or winged species. Commonly, a fixed number of sweeps of a net are made. This gives only relative, not absolute numbers. It has been shown that different workers have a personal factor* that affects the number of individuals they catch of any one species. On different days, or at different times of the day, insects may inhabit different levels† in the vegetation. Sweeping cannot

* See Zubareva, S., 1930, 'On the accuracy of quantitative sweeping with an insect sweep-net'. Bull. Inst. Biol. Res. Perm, vii, pp. 89-104, 1 pl., 14 tables. (Russian, English Summary.)

† See Baskina, V., and Friedmann, G., 1928, 'A statistical investigation of the animal components of two associations in the Kama flood-plain'. Trav. Inst. Biol. Rech. Perm, i, pp. 183-295, 3 pls. (Russian, English Summary.)

be used to compare the numbers of different species, since their reactions to the approaching net will almost certainly be different.

As an example of another method, that tried out recently at the Imperial College Field Station, Slough, in dealing with the Small Cabbage White Butterfly, *Pieris rapae* L., may be described.

This butterfly lays its eggs, one at a time, on cabbage leaves. It is much easier to count the eggs than the adults, which are active fliers and become locally aggregated where flowers are attractive. The egg-number gives an index of the number of fertilized females present. The method adopted is to search a row of cabbages twice a week. Each egg found is marked by making a ring round it on the leaf. In this way, 'new' eggs can be distinguished from old ones and the rate of oviposition calculated. Again, the total number of eggs present at any one time and the number of cabbages bearing one or more eggs can be obtained from the records. The numbers of new eggs give a picture of the seasonal waxing and waning of the insect. The total number of eggs, either present on any one day or laid during the whole season, gives a measure of numbers which can be used to compare densities in different places or different years. For the purposes of such comparisons, it is essential to know whether the sample is homogeneous—whether, if the sample was made larger, the maximum density obtained might not be very different.

If each cabbage is regarded as a quadrat, the relation between absolute numbers and percentage frequency of eggs can be studied. From the number of cabbages which carry one or more eggs at any one time, can be calculated the total number of eggs which should be present if the eggs are distributed at random. In 1933, it was found that, in the first generation (May–June), the distribution was practically at random. In the second generation (August–September), however, there was a wide deviation from a random distribution. This was probably because the drought, acting through a soil-depth gradient, had a differential effect on the growth of the cabbages studied. It is apparent that, when there is a wide divergence from a random distribution, the estimate of absolute numbers depends largely on the quadrats chosen.

This can be illustrated by an experiment carried out in August 1933. Four cabbages, in pots, were placed together in the centre of a lawn about a hundred yards from the cabbage plots. On the lawn, the mean number of eggs laid per plant per day from 14/viii. to 19/viii. was 3.54. During the same period, on the cabbage plots, the mean number was .09, about one-fortieth of number on the lawn. This may probably be explained as follows. The lawn is more sheltered: there

are many flowers available near by and the butterflies attracted to these tend to stay in the neighbourhood and the only oviposition-sites locally available receive a very large number of eggs.

It appears, therefore, that to estimate absolute numbers in an animal to which a wide choice of habitats is available, great care is needed to ensure that the quadrat used on different occasions is the same, not only in position but also in attractiveness. In fact, further investigations are required to decide whether any small scale method can give sufficiently accurate figures. There may be a minimal size of plot (by no means small) in which distribution is effectively random.

It is, perhaps, interesting to compare briefly the concept of minimal area as it arises in plants and animals. In plants, unless there is a definite biotic relationship between the species, there appears no reason why minimal area should be determined by anything but the size of the individuals and their percentage frequency. In animals, biotic relations are frequently much more obvious. An insect will have a certain number of parasites and some of these will have alternative hosts. The minimal area of such an association will be the smallest area in which it is likely that all the hosts and parasites will occur. No studies yet appear to be sufficiently detailed to estimate the size of the minimal area in any particular association. It may well be very large, for it appears that the species living together on a single plant may often have very little effect on one another. The twenty or thirty species of insects living on cabbage at Slough have almost no parasite in common. Where there are alternative hosts, they live on other plant species and the minimal area would have to be large enough to include both cabbage and the other species of host-plants.

Dr. F. G. GREGORY (Visitor) added a few comments.

Mr. J. RAMSBOTTOM read a letter from Mr. E. Wyllie Fenton in which it was stated that a small committee of Grassland Botanists had been appointed by the Agricultural Education Association to study the problem. They had been unable to get any definite statement for their figures from a statistician: they had therefore published their results in the 'open' method. The factors at work are so varied and complex that the application of exact statistical methods is of doubtful value. Time is the greatest factor, for with huge collections of figures the ground could not be covered. Several of the investigators had found their results in agreement with the farmer who judges by final results—beef-production, milk-yield, wool, etc.

The PRESIDENT expressed his interest in the course the discussion had taken. He commented on the fact that

the biological sciences were becoming more mathematical in their outlook and referred to the late Prof. MacLeod's book on the 'Quantitative Method in Biology'. For this book the quantitative method was applied to descriptive and systematic biology. He remembered communicating to the Society a paper by Prof. MacLeod entitled a 'Quantitative description of ten British species of the genus *Mnium*' which appeared in the Society's Journal in 1917 (Journ. Linn. Soc., Bot. xliv (no. 295), pp. 1-58).

7 DECEMBER 1933

Professor F. E. WEISS, F.R.S., President,
in the Chair.

The Proceedings of the previous Meeting held on Thursday, 23 November 1933, having been circulated, were taken as read and confirmed.

The President reported the deaths of Francis Gayner, M.B., F.L.S., and of Dr. Hermann Christ-Socin, F.M.L.S., in his hundredth year.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

Certificates of recommendation of the following candidates for Fellowship were read:—For the second time, in favour of Mahbub Alam, Hamish Boyd Gilliland and Valentine Jackson Chapman; for the first time, in favour of Robert Bernard Benson.

The following candidates were balloted for and elected Fellows:—Violet Margaret Grubb, D.Sc., Edith Dorothy Brain, Alexander Frank Fountain, M.Sc., Robert John Aylwin Wallace Lever, B.Sc., Guy Walter Otter, Cyril Dean Darlington, Ph.D., D.Sc., Frances Lotte Stephens, M.Sc., John Francis George Wheeler, D.Sc., Bernard Dearman Burt, John Spedan Lewis, Raymond Henry Stoughton, D.Sc., and Thomas Edward Wallis, B.Sc.

A pair of boots attacked by 'dry rot'. (Exhibit.)

By Mr. J. Ramsbottom.

MR. J. RAMSBOTTOM exhibited a pair of boots, the whole of the uppers of which had been damaged by 'dry rot' (*Merulius lacrymans*), and were falling to pieces. The fungus had hardly reached the soles; there it has taken the polish off the leather and formed a skin-like layer.

The boots were of medium grade, with uppers of willow-calf leather treated with basic chromium salts, probably

finished with neatsfoot or cod oil. According to the Boot Trade Research Association they had been stored by a retailer in a damp place for not more than a year, and were the only ones of the stock about which complaints had been received. The strands of the fungus had apparently passed through a hole in the corner of the box-lid and had then formed a fluffy mass over the boots, and had attacked the portions most readily accessible.

An Anemone from New Zealand: a plant hitherto regarded as a species of *Ranunculus*. By Mr. John Parkin and Dr. W. A. Sledge.

THE plant originally described from inadequate material by Cheeseman in 1885, and named *Ranunculus tenuicaulis*, is now shown to be a species of *Anemone*, the first member of this genus to be recognized in New Zealand. It is a slender herb with non-creeping rootstock. The leaves, subreniform in outline, are tripartite with incised lobes. The scape is one-flowered with a reduced involucre of three usually unequal leaves. The flower is small, about 1.5 cm. in diameter. The perianth consists of five or six linear lanceolate reddish sepals. The stamens are few and always exceeded by the carpels. The ripe achene is fusiform, with a stiff style bent at its apex in the form of a hook, the tip of which is somewhat spirally twisted. The pointed sepals giving the flower a star-like appearance and their reddish colour may be looked upon as distinctive features. In a flora so markedly lacking in colour, a red *Anemone* was hardly to be expected.

The type of fruit together with the presence of a bifid embryo in the ripe seed leave no room for doubt that the species should be assigned to the section Rivularidium. The plant is quite distinct from any of the other recognized species of this section, and is thus endemic to New Zealand. Its affinities were discussed, and its differences from its nearest neighbour, the Tasmanian species (*A. crassifolia*), stressed.

The plant grows in moist shady places in montane and sub-alpine localities, and the recorded stations show that its headquarters are in Otago, its northern limit being the Tararua Mountains in the south of the North Island.

The present geographical distribution of the Rivularidium section was shown, the points emphasised being its absence from Europe and Africa, and its predominance in South America. It was suggested as more likely that New Zealand and Tasmania received *Anemone* in Tertiary times from South America via Antarctica rather than from Asia.

Dr. T. A. SPRAGUE remarked on the interest of the communication.

Mr. H. N. RIDLEY pointed out the interest of this discovery in the view of the great probability from distribution of the origin of the order Ranunculaceae in the antarctic continent.

Biological observations made during a cruise to the Farøe Islands and off the coast of Scotland in July 1933. By Mr. Francis C. Fraser.

THE cruise was made in the M.Y. *St. George*, and was organized by Col. E. T. Peel, D.S.O., the owner of the yacht, and Col. R. Stapleton Cotton.

The primary object was to trace, if possible, the migration of tunny fish from the Atlantic into the North Sea. It was argued that, as tunny appear off Scarborough in the late summer at a time when the herring fleet is in that area, they ought also to be found further north earlier in the year when the herring fleet is operating from Scottish ports. For the work on tunny the services were obtained of Mr. F. S. Russell of the Marine Biological Association, Plymouth.

In addition to the main work facilities were afforded to make observations on and collect specimens of Cetacea.

Three plankton and hydrographic stations were made between Shetland and the Farøe Islands for comparison with the results of a survey which the vessel of the Fishery Board for Scotland had completed in that region some time previously.

At the Farøe Islands young birds, fresh-water fish, and snails were collected. The only remaining whaling station in the Islands was visited. In the Farøe-Shetland channel a large patch of 'Krill' (*Meganyctiphanes norvegica*) was noted on which birds and fishes were feeding. Several basking sharks (*Cetorhinus maximus*) were seen near the Shetland Islands. Porpoises and a Lesser Rorqual were observed in Linga Sound.

A week was spent hunting dolphins off the Scottish Coast in the neighbourhood of Aberdeen and Peterhead. Many schools were seen, consisting chiefly of White Beaked Dolphins (*Lagenorhynchus albirostris*), but one school of Common Dolphins (*Delphinus delphis*) was also encountered. Three dolphins were harpooned, one *Delphinus*, and two *Lagenorhynchus*, and the carcasses were sent to the British Museum (Natural History), where casts of them have been made. Several photographs were obtained of dolphins in the water.

New evidence of the nature of the reproductive bodies and habit of the Lower Carboniferous Pteridosperms. By Dr. Margaret Benson.

UNTIL last summer, when I secured new incrustation material of the fertile fronds, I was unable to correlate what was known from the petrifications from Pettycur, Fifeshire, Scotland, with the incrustations as then interpreted.

The pollen sac as determined by sections was a synangium of an unusual character. It was attributed on good structural evidence to *Heterangium Grievii*, and was pyriform, showed twelve peripheral loculi, which gave its surface a striped appearance, and it was recorded (*Heterotheca*, 'Botanical Gazette', 1922) that these stripes ran obliquely across its length. It was sessile. Kidston ('Memoir of Fossil Plants') overlooked the above record, but gave an identical account of a sporangium he named *Coseleya*. He recorded three species—one of which was of the same horizon as the above, and two were Westphalian. Prof. Walton (Trans. Roy. Soc., 1926) also figures and describes an identical sporangium. He, again, overlooked *Heterotheca*, and called his specimen a species of *Rhacopteris*.

These all show *Heterotheca* sessile upon a forking rachis.

The new material which has enabled me to correlate these facts is a complete frond of *Adiantites Machaneki* (Stur), which shows a comparable body to Kidston's and Walton's specimens closely associated with the fork—i.e. the place of attachment of the fertile rachis. I submit therefore that the pollen apparatus of four Lower Carboniferous Pteridosperms was of the nature of *Heterotheca*, and consequently this was probably the characteristic pollen apparatus of the Group.

If the above be accepted, we must investigate the nature of *Calathiops*. If reproductive, it must be ovular.

The petrification record is limited to one slide (*C. N.*, 387, Scott Coll. Brit. Museum). This shows the seeds surrounded by their cupules and in a cluster.

Calathiops (Goeppert) is found as an incrustation in three stages of development. Firstly, a short forked rachis with six to twelve bud-like bodies which are obviously composite, showing smaller units inserted on arrested branches of the rachis. Secondly, the branches are longer, forking has taken place, and the buds are more numerous and smaller and less compact. A new megasporophyll secured recently shows this stage—also Kidston's figure (pl. ci, fig. 1). Thirdly, the latest stage exhibits six or seven bifurcations and no buds, but numerous cupules lie about the terminals—obviously seed cupules and many of them are attached.

In this specimen there is no seed in the cupule, but the evidence is overwhelming that the seeds had fallen out, as has been recently shown by Jongmans in *Calymmatotheca*.

Calathiops has been found attached to the plant in *Diplopteridium* and in two species of *Sphenopteridium*, and we may therefore accept it as the characteristic seed apparatus.

Very interesting further evidence of the ovular nature of these bud-like bodies, so long regarded as pollen-sacs, is

afforded by the comparison of genuine pollen-grains (*Heterotheca*, loc. cit., fig. 5) with the seven so-called 'spores' obtained by the solution of these buds in a solvent that does not attack cuticularized membranes (Kidston, loc. cit., pl. cvii, fig. 13).

The pollen grain as found in *Heterotheca* and in the pollen chamber of *Sphaerostoma* measures about 20μ in diameter, whereas Kidston's 'spores' are wrinkled bodies of from $50\text{--}70\mu$ in diameter. Meanwhile, the Y scar is of the same size in both. This suggests that Kidston's bodies are the young embryo-sacs of the ovules in the immature bud, and thus afford an interesting confirmation of Boyd Thomson's observations on the young female spore of Seed-Plants.

In conclusion, it may be helpful to point out that the ultimate phase of the *Calathiops* is essentially a *Calymmatotheca*. Thus Kidston, who originally regarded its cupular lobes as sporangia, was consistent with his earlier views in regarding as synangia the tufts of ovules which separated later into *Calymmatotheca*-like units.

We owe much to Prof. Walton for his recent clear elucidation of the organization of the frond of all known Lower Carboniferous Pteridosperms. On the basis of his work and on the above observations it has been possible to construct drawings representing the habit of these ancient plants.

Dr. H. HAMSHAW THOMAS said that in dealing with rather poorly preserved reproductive structures, such as those from the Teilia quarry which had just been described, they had to distinguish between facts which could be verified and inferences based on morphological theory. There could be no doubt that the structures which Kidston described as synangia in *Schuetzia Bennieana* (= *Calathiops*), *Telangium affine*, and *T. bifidum* in his 'Survey Memoir' contained many small spores. Nobody who had experience in the extraction of spores and spore masses from mummified fossil plants by chemical treatment could question the accuracy of his observations. Many of Kidston's specimens were exceptionally well preserved, and any author who hoped to show that his descriptions are incorrect was embarking on a formidable task. It must be remembered, too, that Kidston described the cupules as well as the synangia of *Telangium bifidum*. In view of the evidence, the assertion that most of the Lower Carboniferous Pteridosperms possessed a pollen apparatus of the type described in *Heterotheca* seemed premature.

The PRESIDENT expressed his agreement with Dr. Thomas's criticism. He mentioned that Prof. Walton, who had seen Dr. Benson's abstract, was very sceptical as to the conclusions it contained.

4 JANUARY 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 7 December 1933, having been circulated, were taken as read and confirmed.

The President reported the death of Dr. Erwin Baur, F.M.L.S.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The Assistant Secretary drew special attention to the recently-published work 'A catalogue of the works of Linnaeus (and publications more immediately relating thereto) preserved in the libraries of the British Museum (Bloomsbury) and the British Museum (Natural History) (South Kensington). Second Edition', compiled by the late BASIL H. SOULSBY, F.L.S.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Thomas Edward Wallis and George Evelyn Hutchinson.

Certificates of recommendation of the following candidates for Fellowship were read :—For the second time, in favour of Robert Bernard Benson ; for the first time, in favour of Arthur Herbert Ridout Woodforde and Noel James Gillies Smith.

The PRESIDENT exhibited an illustration of a spruce forty years old rooted on a willow growing in Vorarlberg.

Character expression in the tomato.

By Dr. F. W. Sansome.

THE induction of tetraploids in the somatic tissue of diploid tomatoes by the method of Jørgensen and Crane provides material which is useful for the comparative analysis of diploids and tetraploids. About fifteen characters are known to be inherited in a Mendelian manner in the diploid tomato. At least twelve of these characters show complete dominance—the heterozygote Xx is similar in appearance to the dominant XX . There are three possible heterozygotes in the tetraploid $XXXX$, $XXxx$, and $Xxxx$. The last type usually exhibits incomplete dominance for these characters. For

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example diploid plants of the constitution RR and Rr have red-fleshed fruits, while plants carrying the recessives rr have yellow fruits. The tetraploid plants of the constitution Rrrr have orange fruits. Similar observations in the tomato and other polyploids have a considerable influence on the views regarding the interactions of genes.

Prof. R. R. GATES said that Dr. Sansome had made an interesting study of the effects of duplicating certain factors in the tomato. This was hardly the place for a technical discussion on the nature of genic differences. It was not at present certain whether genes were fundamentally qualitative or whether some of them were quantitative in nature, nor was it certain whether they could be fractionated. One of the recent developments in genetics was in the investigation of the interaction of genes and in the attempt to analyse the way in which the genes in the nucleus produced their effects in the development of the organism, resulting in the expression of a particular character. Dr. Sansome's investigations of the colour factors in diploid and tetraploid tomatoes were a most useful contribution to this problem. They also afforded a means of comparing the genetic behaviour of size and of colour factors in the same tetraploid organisms.

The PRESIDENT, thanking Dr. Sansome for his interesting communication, expressed his appreciation of the work on tomatoes which was being carried out at the John Innes Horticultural Institution.

Flowering-time and its evolutionary significance.

By Dr. W. Watson, A.L.S.

WHEN lists of plants found in flower during field days were analysed it was noticed that there was a proportionate relationship between the number of a particular group and the supposed position of that group in the evolutionary scale. In the early part of the year those groups considered as evolutionarily early preponderated, whilst later those groups considered as later in evolution were more in evidence. Various methods of indicating this in a mathematical way were attempted. The method finally adopted was one of expedience owing to the fact that comparative data were available. Records of first flowering times in the Taunton district had been kept for fifteen years. The average time of first flowering was obtained for each species for ten years, then the mean time of first flowering was calculated. For example, there were sufficient data for the times of thirteen species of Ranunculaceae. The sum of these was taken, divided by thirteen, and the mean time for the family was

28 April. For fifty-five species of Compositae the mean time was 29 June. In a similar way other families, subfamilies, and even genera were treated and a general correspondence with evolutionary views obtained. This recapitulation was expressed as follows. When a sufficient number of species are taken to obtain the mean times of first flowering for groups of plants, those groups with the earlier flowering time are earlier evolutionarily.

The differences between Carboniferous and Cretaceous conditions were briefly commented upon, and suggestions were advanced that the gradual drying of the earth and the thinning of the atmospheric blanket were important factors in the evolution of the various groups, and that the time in a Mesozoic year, in which these factors were most effective, was reflected to-day in the flowering times of the various groups.

Examples were also given to show that there are some indications that the length of flowering time in a particular group denotes the antiquity of the species, so that the species with the longest time of flowering may usually be considered to represent an ancestral member of the group.

Prof. E. J. SALISBURY said he thought Dr. Watson's interesting hypothesis would need investigating on a much wider basis before one could accept it. Though Dr. Watson had shown a certain degree of correlation to obtain between the supposed phylogenetic sequence of families and their order of flowering, a still more marked correlation existed between order of flowering and type of habitat. Of the entire British Phanerogamic Flora the majority of non-woodland species, some 85 per cent., could be found in bloom in July, whereas the majority of the woodland species were to be found in flower a month earlier and, if we considered the shade flora alone, the majority flowered in April and May.

The tendency for members of certain families to flower at particular seasons might thus be due to a preponderance in a family of species associated with particular habitats. In the Ranunculaceae, to which Dr. Watson had referred, it was true that the highly specialized zygomorphic types are mostly late flowering, but they are also mostly species of open habitats. The very early-flowering actinomorphic members of the family, such as *Eranthis*, *Helleborus*, &c., are members of the woodland shade flora.

Even within the limits of a single species the problem is complicated by the occurrence of geographical races with very diverse times of flowering, such as have been investigated by Turesson, and by the phenomenon of photoperiodism. In this connexion Prof. Salisbury referred to certain plants

of *Caltha palustris*, all collected from the same habitat and grown under similar conditions. Most of these flowered at the normal time, in March, but one individual regularly comes into bloom the third week in January, although this year, doubtless as a consequence of the abnormal summer, flowering began in late November.

Mr. I. H. BURKILL supported Prof. Salisbury and added that a very close agreement between flower-pollination and season must not be assumed.

Dr. M. A. H. TINCKER commented upon an evolutionary aspect of the significance of the time of flowering. Referring to the ecotypes collected from natural habitats by Prof. Stapledon, he pointed out that such 'strains' of grasses and clovers preserved their identity for many generations, as their time of flowering did not overlap sufficiently with that of other strains of the same species to permit free cross pollination. This resulted in greater stability within the Linnean species. The time of flowering can be controlled by adjusting the length of the daily period of light.

Ecotypes differ in their response to a constant period of light. These physiological expressions have, no doubt, a genetical basis; they are accompanied by constant morphological characters.

**New automatic method of recording echo-soundings
(Exhibit). By Dr. Stanley Kemp, F.R.S.**

DR. KEMP gave a brief account of the methods used in deep-sea sounding. He exhibited lantern-slides of areas in the Antarctic, which showed the successful results obtained by the R.R.S. *Discovery II*, with the new echo-sounding apparatus, illustrating the rapid progress which can be made by this means in our knowledge of the topography of the sea bottom. He also exhibited and explained a record made with the latest pattern of self-recording echo-sounding apparatus, taken by the R.R.S. *Discovery II* when passing Cape Finistère at a speed of about 10 knots. The record indicated every inequality in the sea-bottom along the course taken by the ship, and showed soundings varying in depth from 70 to 1200 fathoms.

Prof. J. H. PRIESTLEY asked as to the degree of localization of the area on the bottom from which the echo was thrown back to the recording apparatus.

Dr. G. P. BIDDER asked if it was true that the presence of a dense shoal of fish can be recognized by the echo returned from it to the ship.

Mr. D. J. SCOURFIELD enquired as to the means employed to produce the trace of the depths on the paper, whether

it was by a spot of light acting on sensitized paper or in some other way.

Mr. A. G. LOWNDES, Mr. I. H. BURKILL, Mr. M. A. C. HINTON, and Dr. W. T. CALMAN also spoke.

Dr. KEMP replied that in recent patterns of the apparatus the sound was not widely dispersed but followed the path of a narrow cone: no interference could be detected when soundings were taken alongside a tabular iceberg. Reports had been made of the detection of shoals of fish by echosounding, but he had no personal experience of it. In the self-recording pattern the record is made on damp paper treated with iodide of potassium, and a tracer passes across its full width every few seconds: at the point indicating the sounding an electric current passes through the tracer and liberates iodine on the paper.

18 JANUARY 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 4 January 1934, having been circulated, were taken as read and confirmed.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The Assistant Secretary drew special attention to a donation from Mr. O. R. GURNEY of miniature portraits in pencil of Sir James Edward Smith's mother (Mrs. Frances Smith) and his maternal grandparents (the Rev. John and Mrs. Sarah Kinderley).

Each drawing is accompanied by an inscription in the handwriting of Mrs. Lucy Martineau, a niece of Sir James Edward Smith. The portraits of his grandparents are inscribed at the back of the frames 'J. E. S. fecit', but the back of the drawing of Mrs. Kinderley has an inscription 'Æt 75. R. Batty fecit 1783. E. A. Smith cop^d 1791', presumably in the handwriting of Esther Anne Smith, who was Sir James's sister. It is evident that, finding these three miniatures at some later date, Sir James Edward Smith initialled the two he thought he was responsible for; and the similarity of style of the drawings of the Rev. John Kinderley and Mrs. Frances Smith supports this.

A special vote of thanks was accorded to Mr. Gurney for this donation.

The following Fellow signed the Obligation in the Book of the Charter and Bye-Laws and was admitted :—Abbas Fathi El-Helaly.

Certificates of recommendation of the following candidates for Fellowship were read :—For the second time, in favour of Arthur Herbert Ridout Woodforde and Noel James Gillies Smith.

The PRESIDENT exhibited on behalf of Miss E. K. PEARCE, F.L.S., a fasciated stem of holly found near Morden in Dorset.

**The Biological Work of the Yale North India Expedition.
By Mr. G. E. Hutchinson.**

THIS expedition, under the auspices of Yale University, was led by Dr. H. de Terra. Studies were made throughout 1932 of the geology, palaeontology, and biology of Kashmir, Ladak, and the western frontier of Tibet. The chief biological problems investigated were limnological ; no previous investigators have studied lakes at such high altitudes (14,000–17,300 ft.). The chemical and biological results obtained throw light on the general problems presented by lakes in semi-arid regions. Attention was also given to the ground fauna of the highest zones of vegetation (17,000–18,300 ft.) ; from the collections made it is hoped to elucidate the zoogeographical relations of this fauna.

Mr. D. J. SCOURFIELD said he was particularly interested to hear about the occurrence of *Bosminopsis tibetana* in some of the lakes visited by Mr. Hutchinson. The genus *Bosminopsis* was founded by Sars on specimens also from Central Asia. Some years ago he had received a collection of Entomostraca from South Australia, which contained a species of the same genus, and it was interesting to note that Mr. Hutchinson's specimens were found in salt lakes and that the Australian had been taken in brackish water. Within the last three or four years Mr. Serventy had described a new species from Australia which was very probably the same. As regards the appearance described by Mr. Hutchinson of little black dots in the surface layers of one of the lakes caused by *Bosminopsis*, he asked if this was due to the dark colour of the animals themselves or to the fact that they were carrying ephippia. Although the head-shield of *Bosminopsis* was certainly deep brown, he should not have thought that that alone could have given the black dot appearance unless ephippia were also being produced.

Dr. E. B. WORTHINGTON considered that the major limnological problems revealed by Mr. Hutchinson's very interesting paper were best left over for personal discussion, but he drew attention to one point—the red colour of water in saline lakes which was observed by Mr. Hutchinson and attributed either to *Diaptomus* or *Microcystis*. A certain crater lake in Uganda, which lies close to Lake Edward at the foot of Mount Ruwenzori, and is called Lake Katwe, has a permanent red colour so intense that a glassful looks like claret. This lake is a saturated solution of salt and, incidentally, is the source of an important native salt trade. Microscopic examination reveals no trace of red organisms, but the colour has been attributed by some to bacterial action at the hot springs which feed the lake. A similar red colour of saline lakes has been observed in many parts of the world. May it not be that such conditions owe their origin to some common cause?

Reports of the Cambridge Expedition to British Guiana, 1933.

Illumination in the rain forest at ground level. By Dr. G. S. Carter.

OBSERVATIONS were taken in several types of rain forest in British Guiana with a Bernheim photo-electric cell and three filters by which the light of the red, blue, and green parts of the visible spectrum was separated. An attempt was made to estimate the illumination of the floor of the forest by measuring the light both in the shade at ground level and in the small spots of sunlight which reach the ground. This was done both for the total light and for the light in the separate parts of the spectrum. The results obtained were that in different types of forest there is present in the shade at ground level 0.8 to 0.2 per cent. of the light in full sunlight, and that the total illumination of the forest floor varies in different types of forest from 2 to 0.4 per cent. of full sunlight. A proportionate reduction of 20 per cent. was found in the light of the red end of the spectrum on the forest floor.

Mr. I. H. BURKILL exhibited five lantern-slides of the interior of forests close to the upper Brahmaputra in Assam. He explained the way in which, on some sunny days in December, 1911, he had used a photographic exposure metre to estimate how much light reached the upper surface of the lowly plants under the tall trees; and speaking particularly of the light-diffusion space, to which these lowly plants grow and which is there about five metres deep, he urged that more investigations should be made in the Tropics. The deeper the light-diffusion space the greater the range

of the sun-flecks which pass across the ground vegetation. Their influence should be estimated apart from that of reflected light and light which has passed through leaves on its way to the ground.

Mr. T. B. BLOW said that he was much interested in the work that had been carried on in the rain forest of British Guiana, more especially because he traversed a long distance of it exactly forty years ago, when transit difficulties were great, rowing boats only being available. He was investigating the life history of some of the Podostemonaceae, of which he gave an account to the Society shortly afterwards.

As an old photographer he realized the difficulties which must have been experienced in photographing in the almost darkness at the bases of the trees at the water level: his own photographs were taken mainly in the open stretches of the river and its rapids; though on the higher ground, where the forest was not quite so dense, some were taken to show the carpet of filmy ferns. Many of these photographs were utilized in works on British Guiana by our late fellow James Rodway.

Mosquitoes were noticeably absent and did not disturb open air sleeping in a hammock slung between two trees.

A good motor road has recently been cut right through this forest.

Hyphal fusions and the translocation of protoplasm in the Higher Fungi. By Prof. A. H. Reginald Buller, F.R.S.

By means of hyphal fusions (anastomoses) the mycelium of Ascomycetes, Basidiomycetes, and Fungi Imperfecti becomes converted in an early state of development into a three-dimensional network. Hyphal fusions are also present in the fruit-bodies of these fungi. The advantages accruing to a mycelium through the existence of hyphal fusions were briefly summarized.

It is characteristic of both vegetative and sexual fusions that hyphae or sexual organs destined to fuse act upon one another at a distance. *Telemorphosis* is the phenomenon in which one hypha, acting at a distance, stimulates another hypha to alter its form by sending out an opposing fusion hypha. *Zygotropism* is the phenomenon in which two hyphae, as a result of mutual stimulation, make growth curvatures toward one another and grow toward one another until they meet and fuse.

In general, in Ascomycetes, Basidiomycetes, and Fungi Imperfecti, vegetative fusions are readily formed between adjacent hyphae of one and the same mycelium or of two mycelia of the same species; but, as a rule, they are not

formed between two mycelia of two different species, even when the latter belong to the same genus.

All hyphal fusions are essentially *end-to-end* ones, i.e. when a hyphal fusion takes place, it takes place between the end of one hypha and the end of another hypha.

Four kinds of hyphal fusions have been distinguished: (1) *hypha-to-hypha* fusions, (2) *hypha-to-peg* fusions, (3) *peg-to-peg* fusions, and (4) *hook-to-peg* or clamp-connexion fusions.

In Hymenomycetes and Gastromycetes the clamp-connexion may be regarded as a means for providing between any two cells of a diploid mycelium two septa instead of one and, therefore, two passage-ways for protoplasm instead of one. Thus, owing to the existence of clamp-connexions, the translocation of the protoplasm of a diploid mycelium into a fruit-body, when this is being formed, is facilitated.

There is a central pore, occupied by a bridge of protoplasm, in each septum of the mycelia and fruit-bodies of Ascomycetes, Basidiomycetes and Fungi Imperfecti. All the living cells which make up an individual fungus plant are connected together so as to form a single mass of protoplasm.

Protoplasmic streaming in septate mycelia has been observed by the author in *Fimetaria fimicola*, *Galinospora tetrasperma*, *Pyronema confluens*, *Ascophanus carneus*, *Ciboria* sp. and *Rhizoctonia Solani* (*Corticium Solani*). The movement of vacuoles through the pores of the septa in the mycelium of *F. fimicola* was described. The maximum observed rate of flow of protoplasm along hyphae of *F. fimicola* is 6.0 cm. per hour.

In both *Fimetaria fimicola* and *Pyronema confluens* it was observed that protoplasm often flows from one mycelium to another via passage-ways which have been formed by hyphal fusions.

The causes of protoplasmic streaming in septate mycelia are (1) vacuolar pressure and (2) increase in the amount of protoplasm.

The streaming of protoplasm is biologically significant in that it affords a simple means of transferring building materials from one part of a mycelium to another, or from a mycelium to a fruit-body.

Mr. J. RAMSBOTTOM said that obviously all had listened with interest to Prof. Buller's characteristically enthusiastic account of simple facts. Mycologists were indebted to him for the manner in which for over twenty years he had pointed out the biological significance of different structures, particularly in the Basidiomycetes. The importance of hyphal fusions and of protoplasmic streaming were not likely to remain unrecognized after Prof. Buller's investigations,

which were given in full in the recent volume (V) of his 'Researches on Fungi'.

The PRESIDENT expressed his interest in Prof. Buller's communication and thanked him for the very full and lucid account he had given of hyphal fusions, which seemed to be of considerable physiological importance.

1 FEBRUARY 1934

Dr. W. T. CALMAN, F.R.S., Vice-President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 18 January 1934, having been circulated, were taken as read and confirmed.

The Vice-President in the Chair announced the deaths of Thomas H. Mawson and Dr. D. H. Scott, F.R.S., Fellows of the Society, and moved the following Resolution, which was passed in silence, all standing :—

The Fellows of the Linnean Society of London having heard with the deepest sorrow of the death of Dr. D. H. Scott, F.R.S., desire to put on record their high appreciation of the services he has rendered to the Society during the fifty-four years of his Fellowship. Elected in 1880, he served on the Council for six triennial periods and acted as Botanical Secretary from 1902–1908. He was appointed Vice-President on four occasions and held the office of President from 1908–1912. Throughout his Fellowship of the Society he showed the greatest interest in its work, both by frequent attendance at its meetings and by important palaeobotanical communications. Deploring the loss of so active and distinguished a Fellow, the Society desires to assure the relatives of Dr. Scott of its deep sympathy with them in their bereavement.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

Certificates of recommendation of the following candidates for Fellowship were read :—For the first time, in favour of Norman Ingram Hendey and Sydney Renoden Wycherley.

Note on an unexpected habitat for *Welwitschia*.

By Prof. Noel J. G. Smith.

THE photographs of *Welwitschia mirabilis* Hook. were obtained in January, 1933, during a trip in the coastal desert of South West Africa. Numerous *Welwitschia* plants were seen in two localities, separated by about a hundred miles.

The more southern habitat is in the neighbourhood of Welwitsch, between the Swakop and Khan Rivers, and is well known. Many notes concerning it are incorporated in Pearson's book on 'Gnetales'.

As regards the more northern locality it is not believed that any other author has published photographs or notes concerning the growth of its plants. This locality is at the foot of the Brandberg Mountains, especially near a water-hole at Hungerob. These mountains lying just south of the Ugab River, and not very far from its mouth, are conspicuous in this part of the Namib.

Dr. Welwitsch first found *Welwitschia* much north of this. Thus the Brandberg locality lies between his hunting-ground and the Swakop River locality. Other intermediate localities have either been recorded in print or are known from travellers' stories to exist. Even of this Brandberg locality some news seems to have reached Pearson, and has reached other South African botanists. As the botanical world is interested in gauging the chance of survival of *Welwitschia*, it may be said that the Brandberg plants are numerous and inaccessible. Nature makes the surrounding country difficult to traverse because of its dryness, and mankind adds difficulties, as the territory is diamondiferous.

More interesting than the mere recording of the occurrence of the plant in this place is the behaviour of the plants there. The speaker, seeing *Welwitschia* at the two localities (Welwitsch and Brandberg) within one week, noted the following contrasts. At Welwitsch the great leaves curled back soon after leaving the stem, so that the tips were more or less tucked in, pointing to the place where the stem emerged from the sand. At the Brandberg, on the other hand, the leaves sprawled over the ground, keeping fairly flat. Partly because they thus showed their whole length, partly because of an actual difference in size, the biggest Brandberg leaves looked much larger than any at Welwitsch.

The brownish colour of the leaves at Welwitsch combined with their curling give the impression that the plants were not getting enough water. This was true of plants which were growing in small hollows as well as of those in the flat desert. All of the Brandberg plants were freshly green in comparison.

Signs of regeneration, i.e. young plants, were more to be seen at the Brandberg, though none less than about six years old. The estimate of the age is formed by experience of plants in cultivation.

Most botanists form their ideas about the habitat of *Welwitschia* from pictures of it growing in the sand in treeless and almost flat country. Accordingly it was surprising to find, at the foot of the Brandberg, *Welwitschias* growing under trees, and also some distance up the mountain side. Trees in this territory grow in numbers only where there is a watercourse. In one such dry watercourse, at Hungerob, good specimens of *Welwitschia* were seen among stones and dry grass, frequently very near the base of *Acacia* tree trunks. The best specimens of *Welwitschia* seen on the trip were on, or very near, land moist enough to support trees. The trees and the *Welwitschias* alike must have been tapping underground water. Rain had not occurred, we were informed, for five years, and the burnt state of Angiosperms of the succulent type, with shallow root systems, testified to the lack of surface water.

Some facts recorded by Pearson, including the experience of those who have grown *Welwitschia* in cultivation, are antagonistic to the view that the plant is best suited to extreme desert conditions. Yet the view is so prevalent that further antagonistic evidence, such as this note provides, is not out of place.

Entomological Expedition to Abyssinia, 1926-7 : report on the Orthoptera. By Dr. B. P. Uvarov.

THE collection is sufficiently rich to make it probable that zoogeographical conclusions based on it will be found to be applicable not only to the districts actually explored, but to all the highlands of Central Abyssinia. Possibly an equally thorough investigation of the high mountains of Northern Abyssinia might lead to different conclusions regarding that area.

As regards the several component groups of the Palaearctic fauna, which might be represented among the Abyssinian Orthoptera, there is no trace of the *Angara* group, derived mainly from North and East Siberia, and typical of the subalpine fauna of the mountains in the southern part of the Palaearctic Region, penetrating even to the Moroccan Atlas. The only Abyssinian members of the *Mediterranean* group are three species (two of which were not found above 6,000 ft., the other one being taken between 5,500 and 8,000 ft.) which are also widely distributed in the savanna regions of Africa, and merely indicate a former northern extension

of the savanna fauna. The Palaearctic *Eremian* group is represented by a single species, common and widespread in Palaearctic deserts, and which penetrates Abyssinia, apparently along river valleys, up to 5,500 ft., but is absent from the higher altitudes. There is, therefore, no true Palaearctic element in the material collected at altitudes of 8,000 ft., and upwards.

On the other hand, the Orthopterous fauna appears to be mainly African, the majority of species having been taken at the more moderate elevations, while at high altitudes a considerable admixture of endemic elements is observable. These latter are analysed in some detail in the introduction to the paper. They include certain brachypterous representatives of a genus (*Peropyrrhicia*) of Tettigoniidae, other members of which occur in Meru and Ruwenzori; a species of *Paracomacris*, brachypterous grasshoppers occurring in grasslands at high elevations in Mt. Elgon; a diminutive subalpine subspecies of a lowland species of *Gastrimargus*; a remarkably small species, found under subalpine conditions, of *Heteropternis*, a genus characteristic of African savannas at lower altitudes; two species of *Parasphena*, a typically African genus, with other representatives in Mt. Elgon, Kilimanjaro, &c.

In short, it appears that the endemic species of the Abyssinian highlands represent probably very recent offshoots of forms widely distributed in the savanna areas of Africa; the subalpine species are very similar to those inhabiting other African high mountains, all having common roots in the lowland fauna, though isolation in different mountains has resulted in the development of distinct species. The trend of development of highland from lowland species consists generally in reduction of size and abbreviation of the organs of flight, as well as in a general darkening of the colour.

Dr. HUGH SCOTT showed lantern-slides illustrating localities in which Orthoptera were collected, at various altitudes between 5,500 and 10,000 ft., and, among other notes, added the following:—The highest point at which grasshoppers were collected was about 10,000 ft. on Mt. Chillalo (about the upper limit of forest), where they were taken on short turf dotted with *Thymus serpyllum* or grass dotted with bushes of tree-heath. None was found alive on the desolate heathland of the summit, over 12,000 ft. (the highest point reached), but on a bare rock fragments were found of a large, brightly coloured, lowland grasshopper (*Taphronota* sp.), which lay alongside the excreta of a large bird. The only birds seen on the summit were a pair of thick-billed ravens (*Corvultur*

crassirostris Rüpp.), some large raptorial birds, almost certainly kites, and some ground-thrushes (*Geokichla litsipsirupa simensis* Rüpp.); one of the two larger species must have carried up the grasshopper from hundreds, if not thousands, of feet below in its crop and ejected the fragments on the summit.

Another feature of interest was the capture of a typical specimen of the swarming phase of the Tropical Migratory Locusts (*Locusta migratoria migratorioides* R. & F.) two years before swarms appeared in Abyssinia, a fact tending to show that the swarming phase may occasionally be produced locally.

Dr. Hugh Scott also reported the progress made in working out the material of many orders of insects, and added some comments about the possible bearing of past climatic change on the mingling of faunistic elements at high altitudes in Abyssinia.

Successful introduction of Plants from West Africa to Tropical America. By Dr. J. M. Dalziel.

THE Allison V. Armour Expedition (of Jan.-Apr. 1927) on the Motor Yacht *Utowana* to the coast of West Africa visited the following countries: Gambia, French Guinea, Sierra Leone, Liberia, Gold Coast, Fernando Po, and Cameroons. This expedition has been described by Dr. David Fairchild in

'The Scientific Monthly,' Feb. 1928, vol. xxvi. 97-127, 'Two Expeditions after Living Plants,' and in 'Exploring for Plants,' New York, The Macmillan Co., 1930. The purpose of the voyage was to collect 'living seeds and plants of any species, whether wild or cultivated, described or new, which appeared likely to have any definite use when cultivated in America'. The work was, therefore, more related to horticulture than to botanical collecting, although herbarium material was also collected.

The period of seven years is perhaps too short to estimate the full results of such introductions. The experimental gardens in which these seeds or cuttings, &c., were tried out before distribution are: The Chapman Field Garden, Coconut Grove, South Florida; The Harvard Soledad Arboretum at Cienfuegos, Cuba; and The Summit Gardens, Panama. The behaviour up to date of some of the species is recorded below, and I am indebted to Dr. Fairchild for the details here given.

ACACIA ARABICA Willd. (*A. Adansonii* Guill. & Perr.) from Gambia. Small shrubs are established, slow-growing and not yet fruiting.

ADANSONIA DIGITATA L. from Gambia. There is now a tree 3 ft. in diameter at Florida. From previous introductions there are some fair-sized specimens already established in

South Florida ; none so far have fruited, but they are expected to do so. On poor land it makes slow growth.

AFRAMOMUM sp. from Victoria, Cameroons. Plants have grown from seed, and have flowered but not fruited.

ALCHORNEA CORDIFOLIA Muell.-Arg. from Sierra Leone has fruited in the Florida Arboretum.

ANONA SENEGALENSIS Pers. from Gambia. A tree 8 ft. high has been raised in Florida, flowering abundantly ; as there is only one specimen it never sets fruit.

BORASSUS FLABELLIFER var. *AETHIOPUM* Warb. from Gambia. Specimens are established in Cuba and Florida. They have grown very slowly, but have shown themselves to be adapted to the conditions in these two localities.

CALONCOBA GILGIANA Gilg from Gold Coast. A single bush is doing well in Cuba, where it is very decorative when in flower and has already fruited : it is expected to become a door-yard shrub. It has failed to grow in Florida.

COMBRETUM GRANDIFLORUM G. Don from French Guinea. This large creeper has grown especially well as a trellis vine in South Florida, with gorgeous lacquer-red tresses of winter blooms. Seeds have formed and hundreds of seedlings have been distributed widely. It is likely to become one of the most highly prized pergola vines.

CYMBOPOGON GIGANTEUS Chiov. from Gambia. It has flowered now for several years but not seeded, and is used to cut for decorative purposes. The fragrance of the leaves seems to be less appreciated than that of the cultivated species of *Cymbopogon*.

CYRTOSPERMA SENEGALENSE Engl. from French Cameroons. This striking aroid has grown particularly well in a pond at Cuba, where it has flowered and fruited, and seeds have been distributed. ' It deserves to be grown in all the tropical water gardens of the world.'

DIALIUM GUINEENSE Willd. from French Guinea. This has grown well and fruited abundantly both at Panama and at Cuba, but has so far not borne fruit on the rocky limestone soil of South Florida. The black velvet fruits are decorative, and also pleasant to suck.

ELAIS GUINEENSIS Jacq. from Cameroons. Specimens bearing fruit have been established at Panama, Cuba, and Florida, rapidly growing and early fruiting. The oil palm has, of course, been frequently introduced.

ELAEOPHORBA DRUPIFERA Stapf from Gold Coast and from Fernando Po. A drought-resistant tree which has grown well at Florida ; now 10 ft. high and sufficiently ornamental to be regarded as a probable park or street avenue tree ; grown from cuttings.

ERYTHRINA SENEGALENSIS DC. from Gambia. This has flowered well in Cuba, where the Director regards it as one of the most handsome of the genus. It is reported that two forms have appeared differing in colour of the flowers. This peculiarity has not, so far as I know, been noted in West Africa.

ERYTHROPHLEUM GUINEENSE G. Don, West African Ordeal Bark Tree, from Gambia. This has grown into a splendid shade tree at Cuba, and has already fruited there, but in Florida it grows more slowly.

EUGENIA CORONATA Schum. & Thonn., a shrub from Gold Coast. Only five or six seeds were collected near the sea-shore. It has suited the limestone rock of the Florida Arboretum, and has fruited regularly and abundantly. It forms a useful hedge, and hundreds of young plants have been distributed. Birds eagerly eat the fruit and it is likely to become widely spread as a popular shrub for amateur gardeners.

FICUS CAPENSIS Thunb. from Gambia and French Guinea. This has fruited in Florida, but not seeded. It is being used as grafting stock for the edible fig.

FICUS ITEOPHYLLA Miq. from Gambia. This has grown to 20 ft. in Florida, and is covered every spring with small, juicy and very sweet figs which attract hosts of Mocking Birds and Cardinal Finches. No seeds have formed. It is proposed to establish it as a bird food.

FICUS PLATYPHYLLA Del. from Gold Coast. This has proved exceedingly successful in South Florida, already 20 ft. high, grown from seed, and with its handsome broad leaves is likely to be planted out extensively in parks and streets.

FICUS VOGELIANA Miq. from Cameroons Mt. This has grown to 10 ft. at Coconut Grove, but shows no sign of fruiting.

FICUS VOGELII Miq. from Gambia. This is now forming stately shade trees with aerial roots of the banyan type. It has grown particularly well in South Florida, where it is to be popularized as a park and probably a street tree.

HYPHAENE THEBAICA Mart. from Gambia. Seeds have germinated, but it has been necessary to use very deep boxes to accommodate the long descending shoot, which is so sensitive to handling in removal that, so far, no palms of this species have been planted out in the open in Florida, Panama, or Cuba.

JASMINUM DICHOTOMUM Vahl, from Gold Coast. This is well established now as the 'Gold Coast Jasmin', with dense glossy foliage and white, very fragrant flowers, covering the pergolas of many amateur gardeners in South Florida.

It is in flower most of the year, and the blue-purple fruits are fleshy and sweet and much eaten by Mocking Birds. This is an example of a plant which has succeeded beyond all expectation on the limestone soil of that region. The open Accra Plain, Gold Coast, where the few seeds were collected, is not a lime formation. It is resistant to hurricanes, and being rapidly spread by birds there is even a prospect of its becoming embarrassingly common in the Hammocks of South Florida. This plant has been described and illustrated in 'The National Horticultural Magazine (of Washington)', vol. ix, no. 3, July 1930, 'The Gold Coast Jasmin', by David Fairchild.

MALACANTHA ALNIFOLIA Pierre from Gold Coast. This has fruited in Cuba; also growing 5 ft. high in Florida, but not yet in fruit.

MUSANGA SMITHII R. Br. from Cameroons Mt., where it is, perhaps the most rapidly growing tree, with light spongy wood. In Cuba, where the situation is rather dry, it has grown quite slowly, producing in five years trees no larger than in a single year or less in West Africa. They have not yet fruited.

PICRALIMA NITIDA Th. & H  l. Dur. from Gold Coast. A small specimen has been grown, under protection from cold, in Coconut Grove, but the locality appears to be too cold for it. No report of its behaviour in Panama or Cuba.

PODOCARPUS sp. (? *Mannii* Hook. f.) from Cameroons Mt. This has grown well to 15 ft., but has not yet fruited.

RITCHIEA REFLEXA Gilg. & Benedict from Gold Coast. Forms a dense evergreen vine, ideal as a protection against sun, but the white flowers seem to have lost their fragrance. It is regarded as one of the most vigorous and satisfactory trellis vines ever known at Coconut Grove, Florida.

STERCULIA TRAGACANTHA Lindl. from French Guinea. Growing abundantly 15 ft. high at Florida, but shows no signs of fruiting.

STROPHANTHUS SARMENTOSUS A. P. DC. from Gambia, Gold Coast, &c. This forms a very ornamental pergola vine, flowering each year, but not fruiting so far. In the Florida Arboretum it requires protection from wind.

SYNSEPALUM DULCIFICUM Daniell from Cameroons. This has grown freely and bears fruit while still in pots in the greenhouse in Florida, Panama and Cuba. The sweet juice of the fruit has a peculiar after-effect on the tongue, causing sour fruits like limes and lemons to taste like a sweet orange.

TALINUM TRIANGULARE Willd. from Gold Coast, where it is a pot-herb and naturalized weed introduced originally from

tropical America. It grows freely in gardens in South Florida, where it has previously been introduced from Ceylon; a popular vegetable.

TEPHROSIA VOGELII Hook. f. from Cameroons. It has grown and fruited abundantly in South Florida, and is the subject of experimental work on insecticides.

The following supplementary list includes plants collected on the Allison V. Armour *Utoana* Expedition now growing in the Chapman Field Arboretum, Florida, either in the open or in boxes preparatory to being set out. The local conditions in South Florida are peculiar. The soil is alkaline, strongly impregnated with lime, and the frequent occurrence of strong winds and even hurricanes renders it necessary to grow the seedlings for a much longer period than elsewhere before placing them out in permanent positions. A few of the plants in the list are not West African, but were collected in the Botanic Garden, Victoria, Cameroons:—

<i>Detarium senegalense.</i>	<i>Musanga Smithii.</i>
<i>Drypetes molunduan.</i>	<i>Eugenia coronata.</i>
<i>Physhedra eglandulosa.</i>	<i>Ficus platyphylla.</i>
<i>Rhynchosia calycina.</i>	<i>Ritchiea reflexa.</i>
<i>Baissea multiflora.</i>	<i>Bauhinia</i> sp.
<i>Azelia bracteata.</i>	<i>Dialium guineense.</i>
<i>Sterculia tomentosa.</i>	<i>Jasminum dichotomum.</i>
<i>Drymophloeus</i> sp.	<i>Monodora tenuifolia.</i>
<i>Morinda quadrangularis.</i>	<i>Picralima nitida.</i>
<i>Ficus</i> sp.	<i>Cassia sieberiana.</i>
<i>Amomum</i> sp.	<i>Ficus capensis.</i>
<i>Phialodiscus unijugatus.</i>	<i>Combretum</i> sp.
<i>Artocarpus falcatus.</i>	<i>Azelia africana.</i>
<i>Bosquiea angolensis.</i>	<i>Tetrapleura Thonningii.</i>
<i>Elaeis guineensis</i> var. <i>Poissonii.</i>	<i>Erythrophleum guineense.</i>
<i>Elaeis guineensis</i> var. <i>tenera.</i>	<i>Carica Papaya.</i>
<i>Chrysophyllum cainito.</i>	<i>Bauhinia</i> sp.
<i>Cassia braziliensis.</i>	<i>Balanites aegyptiaca.</i>
<i>Phrynium</i> sp.	<i>Persea americana.</i>
<i>Sterculia</i> sp.	

John Ellis (? 1705–1776) and his manuscripts.

By Mr. S. Savage.

[Abstract.]

THE biography of John Ellis, celebrated for his book published in 1755 entitled 'An essay towards a natural history of the Corallines ...', still remains to be written. Sir James Edward Smith wrote two short biographical sketches of him, one in Rees's 'Cyclopaedia' in 1805, and another in 'A selection from the correspondence of Linnaeus ...' in 1821. Both are in some respects inaccurate, and fail to give an adequate account of the man or his work.

The Ellis MSS. came into the Society's possession in 1829, when the Linnean and Smithian collections were purchased from Sir James Edward Smith's executor. They consist of five note books of various sizes, a miscellaneous collection of unbound MS. material, and a collection of letters received by Ellis. The note books contain Ellis's scientific memoranda, and many draft letters from the year 1755 to 1776, the year of his death. These MSS. bear witness to the wide range of his interests in botany, zoology and horticulture.

The date of Ellis's birth is unknown. Smith made the conjecture of about 1710, based upon the MS. containing some of Ellis's early studies in arithmetic dated 1723,—his assumption being that a boy would be about twelve years of age when he began to learn vulgar fractions. It seems more probable that about 1705 is nearer the truth, for Ellis in a letter to Dr. David Skene dated 1768 stated that he was 'past the grand climacteric' (i.e. his 63rd year). Further, Thomas Pennant, in a letter to Ellis dated 1769, calls him a 'veteran naturalist'.

The place of Ellis's birth is also unknown. In his first sketch, Smith stated that he was born in London; in the second that he was 'a native of Ireland'. The only direct contemporary statement comes from Ellis's calumniator, D. S. A. Büttner, who referred to 'John Ellis from Ireland'. The correspondence gives evidence that although he had relatives in Ireland, and may have been born there, there is reason to believe that he came of English stock.

The correspondence shows that Ellis visited the Islands of Scilly in 1744, from which time—if not earlier—he was keenly interested in plants; and that, at least as early as 1745, he was established as a merchant in Lawrence Lane, Cheapside, where his business was in connexion with the Irish Linen trade. He was appointed London Agent of the Linen Board of Ireland in 1753, having taken an active part in promoting two Linen Bills for which the Board had petitioned Parliament.

Although Smith stated 'of the time of his marriage or any particulars concerning his wife, we have no account', without any doubt he married late in 1753 or early in 1754; letters of congratulation from his friends prove this. His wife's maiden name was Peers; her Christian name cannot be traced. A daughter, Martha, was born about the year 1755, who survived him, and two other daughters later, who died in infancy. On 15 June 1758 his wife died of 'a Consumption', and this loss deeply affected him. After relating the circumstances to his cousin, Henry Ellis, governor of the American Colony of Georgia, he adds: 'If I was now quite disengag'd from the incumbrances of the World I would

go to Georgia and turn planter for I have no Joy here'. Some part of the period immediately following his wife's death appears to have been spent away from London. Writing to Knowlton, the famous gardener, in 1759, he refers to 'being much in the Country in Surry and Sussex this Summer'.

How long he continued as a merchant in Lawrence Lane is uncertain. In 1764 he moved to temporary quarters in Queen Street, Bloomsbury, to be near his friend Solander. Early in the same year he was appointed King's Agent for West Florida, and by the next year he had removed to chambers at No. 5 Coney Court, Gray's Inn, where he remained until the year 1773, living 'like a Monk in his cell quite alone', as he expressed it to Dr. David Skene. In 1770 the further appointment of King's Agent for Dominica was given to him.

About the year 1773 his health began to fail, and he removed to The Square, Hampstead, in the hope that better air would improve his condition; and probably spent his last three years there. By 1774 his eyesight had become seriously affected, and his latest notes give pathetic evidence of this. He died intestate on 15 October 1776. His place of burial is unknown. The administration of his estate was granted to his daughter Martha in October 1777. The bulk of his museum was sold by auction in London in June 1791. (Nichols, Lit. Anec., states that his library was sold in 1786.)

Ellis was elected a Fellow of the Royal Society in 1754, and was awarded the Copley Medal in 1768. Linnaeus named a genus of Hydrophyllaceae in his honour; Patrick Browne had previously founded a genus *Ellisia* which had become a synonym under *Duranta*.

No portrait of Ellis is known. From some source, Smith was able to state that his person was tall, his features expressive and strongly marked'. In the recently-published life of Lettson, by J. J. Abraham, there is the following pleasing reference to Ellis, from the diary of Betty, Dr. John Fothergill's niece, under date 24 November 1769:—'Second day. John Ellis Esq', a virtuosi friend of my uncle's breakfasted here. He is a very humorous comical old gentleman.'

That so much is lacking that should be known about one who stands as a fine type of the non-professional naturalist appears to be due to several causes. In the first place, Ellis's interests were so centred on the objects and researches that compelled his attention that he usually omitted from his correspondence all reference to personal matters that would afford good biographical data. Secondly, it is probable that Ellis's only surviving child, Martha (who became Mrs. Alexander Watt, of Northaw, Herts), when presenting her father's MSS. to Smith retained any documents of purely personal interest. Mrs. Watt died in 1795, and could her

descendants be traced today they might be able to produce documents capable of filling up some of the gaps in Ellis's biography.

[Various aspects of Ellis's work were here touched upon, such as the steps by which he came to write the 'Essay', his other zoological works, his researches in connexion with the spores of fungi and microscopic animals, and his contributions to Systematic and Economic Botany.]

At least from the year 1757 till his death Ellis was continually endeavouring to benefit our American and West Indian Colonies by the introduction of useful plants from other parts of the world. In 1758 he laid before the Royal Society of Arts, to which he belonged, lists of plants he considered could be grown in the colonies, together with a strong plea for the establishment of Colonial botanic gardens.

Ellis was specially interested in the plants producing coffee, tea and cocoa. He had two friends in China, Thomas FitzHugh and John Bradby Blake, who sent him seeds of the tea plant. One large sending from FitzHugh reached him in 1760, and he at once despatched to the American Colonies fourteen balls of wax containing the seeds, but the ship conveying them was captured on the high seas. In 1768 Ellis raised a tea tree in a pot in Gray's Inn, then sent it to W. Aiton the Royal gardener at Kew, who 'soon made it a fine plant'. In the following year James Lee reported to Ellis that tea plants had been raised in several places in England. In 1772 Ellis, writing to governor Tryon of New York, said that James Gordon was increasing tea plants fast, and added:—'It is my ardent wish before I die to see the Tea tree established in North America. I am perswaded from the variety of climates soils & situation it may be propagated there.'

For many years Ellis had endeavoured to obtain specimens of the flowers of *Theobroma Cacao*, and at last, towards the end of his life, some were sent to him, and in one of his note books is a fine drawing of the flower of this plant.

Ellis retained to the last his keen interest in the introduction of plants. On 18 May 1776—five months before his death—he published in a daily newspaper a letter urging the importance of introducing the Bread Fruit into the West Indies, as a future measure against famine. This is interesting in view of the fact that it was not until 1787 that Capt. Bligh, on Sir Joseph Banks's recommendation, attempted to carry out this project in the ill-fated *Bounty*.

Among the intimate friends or correspondents of Ellis are the following:—Linnaeus (the correspondence covering a period of fifteen years), Stephen Hales, Collinson, Fothergill, Garden, Solander, Rev. William Borlase, Thomas Pennant,

Dr. David Skene, Dr. W. Brownrigg, Ehret, Oeder, van Roÿen, Schlosser, du Hamel du Monceau, Dr. John Hope, James Lee and Benjamin Franklin.

From a bibliographical standpoint, it may be of interest to record that in 1766 Ellis presented to the Royal Society some MSS. and correspondence of Dr. William Sherard, the founder of the Oxford Sherardian professorship.

Sir SIDNEY HARMER expressed his great interest in Mr. Savage's communication. John Ellis was a man whose work was of outstanding importance in establishing the animal nature of Zoophytes. A very large proportion of the species introduced by Linnaeus in the tenth edition of the 'Systema Naturae' were founded directly on the admirable figures and descriptions of Ellis; with the result that, in contrast with many other groups, most of the Linnean species of Zoophytes can be recognized with certainty. Ellis showed remarkable insight in his arrangement of species; and the sanity of his judgment is indicated by his discussion of the affinities of Sponges and Fungi, which he refused to regard as related to any of the polype-bearing organisms. Sir Sidney further commented on the fact that the great work of Ellis, the Essay on Corallines, must have been produced as a comparatively large edition, since copies are constantly being offered for sale in book-catalogues.

15 FEBRUARY 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 1 February 1934, having been circulated, were taken as read and confirmed.

The President reported the death of Dr. Lilian J. Clarke, F.L.S.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted:—Edith Dorothy Brain, Lily Newton, David McCall and Violet Margaret Grubb.

Certificates of recommendation of the following candidates for Fellowship were read:—For the second time, in favour of Norman Ingram Hendey and Sydney Renoden Wycherley.

The Life-History of *Gymnogongrus Griffithsiae* Mart. and *Ahnfeltia plicata* Fries. By Miss B. D. Gregory (Visitor).

GYMNOGONGRUS GRIFFITHSLAE Mart. bears, on its thallus, small pustules of the so-called parasite *Actinococcus aggregatus* Kütz. Their development is preceded by the formation of procarps which typically consist of a bearing-cell surmounted by a two-celled carpogonial branch. The presence of male organs is uncertain. Ultimately, though no fertilization process has yet been observed, the bearing-cell becomes greatly enlarged, and, from it, are cut off many small cells connected with it by plasmodesma. By further cell-division the tissue of the mature nemathecium pustule is formed, from which, ultimately, tetraspores are liberated. Thus the so-called parasite *Actinococcus aggregatus* Kütz. is, in reality, the asexual phase of *Gymnogongrus Griffithsiae* Mart. developed upon the sexual plant.

AHNFELTIA PLICATA Fries bears, on its thallus, encrustations of the so-called parasite *Sterrocolax decipiens* Schmitz, now known to be the asexual phase of the *Ahnfeltia* plant. The pustule arises as a result of subdivision of certain cells of the limiting-layer of the host, and, ultimately, from the apices of the nemathecium filaments monospores are cut off. No procarps have been observed. Male plants occur and these do not bear the pustule. The male organs are located in superficial sori, spermatia being abstricted terminally. It is possible that in *Ahnfeltia* a very reduced sexuality occurs, certain vegetative cells taking the place of procarps. The spermatia would appear to be functionless.

Experimental taxonomy in marine algae, with special reference to *Caulerpa*. By Mr. Geoffrey Tandy.

MARINE algae have been regarded as extremely plastic forms; so much so, that Schleiden questioned the existence of species at all, and said there were only 'forms'. Early taxonomists (Linné, Gmelin, Turner) were exceedingly dubious about the possibility of recognizing genera, and the early segregators (Stackhouse, Agardh, Greville) made vast assemblages under relatively few generic names. Since then the number of names has been increasing rapidly: the process of 'splitting' has gone on at a great rate.

Perhaps nowhere in the field has taxonomic 'opinion' been more confounded than in the genus *Caulerpa*. Of more than 120 combinations existing when Mme Weber-van Bosse monographed the genus in 1898, only 54 were used by her—the rest remained as synonyms. Since that time the tendency has been towards segregation and finer discrimination. Recent

workers (Howe, Taylor, Svedelius) have revived names put as synonyms by Mme Weber. All through it has been largely a matter of opinion. Sometimes a lucky find has shown distinct 'species' on the same stolon, but experimental demonstration has been lacking.

Three species of *Caulerpa* are very abundant at Tortugas: *C. racemosa* (Forsk.) J. Ag., *C. cupressoides* (Vahl) Ag. and *C. sertularioides* (Gmel.) Howe. Taylor (Marine Alg. Flor.) recognized seven varieties of *C. racemosa*, seven of *C. cupressoides*, and three forms of *C. sertularioides*. The characters relied on for these separations can be varied by transplant experiment on a single ramulus. In addition, there is evidence that *C. peltata* Lamour, and *C. fastigiata* Mont. are only forms of *C. racemosa*.

The possibility of an Alternation of generations in the Myrionemaceae. By Mr. A. D. Cotton.

THE Myrionemaceae are a small family of the brown algae usually placed next to the Ectocarpaceae. They consist of small epiphytic genera composed of a basal disk formed of radiating filaments from which arise erect assimilating filaments and also unilocular and plurilocular sporangia.

The family is in considerable confusion systematically both as regards genera and species. A monograph based on living and herbarium material and a study of all the type-specimens *extant* was prepared by the speaker previous to 1914; but, owing to a desire to interpret the taxonomy of certain obscure species and to obtain a fuller knowledge of the life-history of the family by means of cultures, this has not been published.

The discovery by Sauvageau and others of a minute gametophytic stage in several families of the Ectocarpales has given a new incentive to the study of the group. The occurrence in the whole of the Ectocarpales of a morphological alternation of generations seems not unlikely, and the elucidation of the life-history of the Myrionemaceae becomes more than ever desirable.

In those Myrionemaceae with both unilocular and plurilocular sporangia we may assume that there is a reduction division in the former, and that the zooids which are liberated are haploid. If they do not fuse, we may assume that they give rise to an ectocarpoid gametophyte which probably bears isogametes. In the plurilocular sporangia we may assume that there is no reduction division, but the production of diploid zooids which give rise again to a sporophytic, diploid, discoid *Myrionema*.

As to those species with only plurilocular sporangia, now that we know that there is a definite alternation of generations in several families of the Ectocarpaceae, the old idea that

they represent a non-sexual group is unthinkable. There are several possibilities—(1) Unilocular sporangia may exist, but have not yet been discovered. (2) There may be repeated sporophytic cycles in which the gametophyte stage occurs only occasionally. (3) The haploid and diploid generations may be similar in form and only distinguishable cytologically and by the behaviour of the zooids. If there is no unilocular sporangium a further point with regard to these species arises, namely, where does the reduction division take place. It is much more difficult to conceive of its occurrence in the primordial of a plurilocular sporangium than in the mother-cell of the unilocular sporangium. In the Ectocarpaceae the haploid number of chromosomes is usually eight and the diploid sixteen—hence a cytological study might give a clue.

One unexpected discovery has resulted from Miss M. Parke's work on the Mesogloioaceae. The basal disk of the young sporophyte of *Castagnea Zosteræ* has 'spines' similar to the 'ascocysts' of *Ascocyclus orbicularis*. Though not proved by cultures, there is practically no doubt that the *Castagnea* plants are organically connected with the disks and that the disks themselves are those of *A. orbicularis*. This species, therefore, is the early stage of the sporophyte of *C. Zosteræ*.

A discussion on these communications followed.

Dr. MARIE ROSENBERG: The possibility of growing algae in culture is chiefly important in any work on the life-cycles. Very frequently the sporelings grow well for some time, but suddenly cease to grow, due to various different causes of laboratory conditions. A solution has been found that shows the best results for marine algae of almost every group. B. Föyn, working on *Cladophora* and *Ulva*, used this solution, he calls 'Erdschreiber' containing 50 ccm. soil extract*, 0.1 g. NaNO_3 , 0.02 Na_2HPO_4 , 1000 ccm. sea water. The series of photos shown demonstrates that it is the soil extract alone that accounts for the very remarkable result. Sporelings of *Ulva lactuca*, all of the same age, grown under the same conditions as to light and temperature, were shown in sea water and different nutritive solutions. The sporelings grown in 'Erdschreiber' for the same length of time—and under the given laboratory conditions—are almost a hundred times as large as those grown in sea water alone. Probably this success is due both to the colloidal medium and to the humic-acids of the soil extract. This solution has so far been tried on Chlorophyceae, Phaeophyceae, and a few Rhodophyceae, showing in all cases remarkable results.

Dr. MARGERY KNIGHT also spoke.

* 1 kg. soil and 1 lit. water are boiled for 2 hours, allowed to settle for 3 or 4 weeks, not filtered, and carefully decanted.

Prof. L. NEWTON said that Miss Gregory's work on *Gymnogongrus* and *Ahnfeltia* is especially important from an evolutionary standpoint. The Florideae have evolved by two delays in the reduction division in the life-cycle, and *Gymnogongrus Griffithsiae* appears to be similar to *Phyllophora Brodiaei*, where a subsequent retrogressive step in the life-cycle has eliminated the *second* delay. In *Liagora tetrasporifera* the tetraspores are borne in the cystocarps, but that appears to be the result of only *one* delay, the second delay never having occurred.

Dr. E. M. DELF also expressed appreciation of the opening papers. She was especially interested in the microgenerations of the brown algae dealt with by Mr. Cotton, some of which are well known as gametophytic. The discovery of the gametophyte of *Macrocystis* by Mrs. Levyn was mentioned as an example of the great contrast between sporophyte and gametophyte in the Laminariales. The microphyte of the Laminariales differs from the sporophyte not only in size and in its simple structure, but also in habit. The most extreme case is probably that of *Phyllaria reniforme*, in which Sauvageau (1918) found the gametophyte as an endophyte (which he regarded as parasitic) in the thallus of *Lithophyllum lichenoides*. The ecology of the microphyte of the brown algae would repay investigation.

Dr. V. M. GRUBB noted the great interest of Miss Gregory's work on incomplete life-cycles from the cytological point of view and enquired if any attempt had been made to ascertain the cytological cycle in the example quoted of *Gymnogongrus Griffithsiae*, where tetraspores were formed but no functioning male and female organs were known to occur. In *Rhodymenia palmata*—another red alga with an incomplete life-cycle—it had been shown that a reduction division actually did occur in the tetrasporangium (Westbrook, 1928), but how the diploid condition originated again was not known here either.

The work quoted by Dr. Rosenberg on the growth of algae in culture solutions opened up many possibilities in the red algae and, in particular, the methods might be used to throw light on the life-history of such forms as *Porphyra*, which in certain regions is found on the shore only for eight months in the year and then disappears for the remaining four months.

Mr. RAMSBOTTOM, in replying to the President, said that he had thought that a symposium on sea-weeds might serve in place of a discussion which he had hoped to arrange. The only point he would add to the discussion concerned the implication that the work of the older algologists was not worth our consideration. It could not be said too strongly that no effort should be spared to understand their standpoint and to ascertain which forms they described. The casual

use of names was to be deprecated. It was essential for the advancement of algology—as of other branches of botany—that names should be used with their proper significance. There would then be more likelihood that the facts which may be under discussion referred to the same organism. It was always well to know what we were talking about. Delving into the older work made for clarity and not for confusion.

Miss GREGORY replied that in the region of the developing pustule on *Ahnfeltia*, the medullary cells often undergo peculiar changes, marked, firstly, by dense contents and a large nucleus, and later by the formation of outgrowths between neighbouring cells, resulting in their confluence. That these fusions have any sexual significance is extremely doubtful. They are very possibly concerned with the nutrition of the pustule and the monospores formed therein.

The PRESIDENT expressed the thanks of the Society to the various speakers, who had contributed to such a successful meeting devoted to a great variety of algological subjects.

1 MARCH 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 15 February 1934, having been circulated, were taken as read and confirmed.

The President reported the death of the Rev. Canon G. R. Bullock-Webster, F.L.S.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellow signed the Obligation in the Book of the Charter and Bye-Laws and was admitted:—William Stephenson.

Certificates of recommendation of the following candidates for Fellowship were read:—For the first time, in favour of Paul Westmacott Richards and Ernest James William Barrington.

The following candidates, whose names were read for the third time, were balloted for and elected Fellows:—Don Carlin Gunawardena, B.A., M.Sc., Harold George Fisher MacDonald, Mahbub Alam, M.Sc., Hamish Boyd Gilliland, B.Sc., Valentine Jackson Chapman, B.A., Robert Bernard Benson, M.A., Arthur Herbert Ridout Woodforde, Noel J. G. Smith, M.A., B.Sc., Ph.D., Norman Ingram Hendey and Sydney Renoden Wycherley.

The races of the European wild cat (*Felis silvestris*).**By Mr. R. I. Pocock, F.R.S.**

MR. R. I. POCOCK pointed out that several additions to our knowledge of the species had been made since the publication in 1912 of Mr. Gerrit Miller's 'Catalogue of the Mammals of Western Europe'. Several adult examples of the Scotch wild cat (*Felis silvestris grampia*), sent to the British Museum during recent years, showed that this race is considerably larger than would be inferred from Mr. Miller's records, and is only a trifle smaller than the southern Spanish race (*F. s. tartessia*) and somewhat larger on the available evidence than the typical central European race (*F. s. silvestris*). Three new forms had been described, one from Corsica and one from central Italy, both of doubtful systematic status, and a third from Trebizond, which was shown to be indistinguishable from the previously named Caucasian race (*F. s. caucasica*). As regards the present distribution of the species, the evidence on the whole seemed to point to the conclusion that it entered Europe from south-western Asia too late to make its way into the large islands of the Mediterranean, but in time to enter Great Britain by the southern route before the formation of the Straits of Dover.

MR. N. B. KINNENAR remarked that the wild cat was now not rare in the north of Scotland, and a good account of its increase and spread was given by the late Mr. J. G. Millais in 'The Times' of 26 October 1926. According to that article the wild cat reappeared in Inverness-shire, from north of the Caledonian Canal, about 1912 and, after becoming established round Lochs Erich and Laggan, spread farther south into Perthshire, where one was killed at Murthly, twelve miles from Perth, in 1925.

Mr. Kinnear further stated that owing to the increase of tree planting the safety of the wild cat appeared to be assured, as it had taken to the young plantations on account of the rabbits and, where the plantations were under the charge of the Forestry Commission, the cats were encouraged, as they helped to keep down the rabbits.

DR. G. P. BIDDER asked if Mr. Pocock would deny or confirm the old stories of the ferocity and strength of the wild cats, instancing the account of a Highlander attacked by a cat which he fought for two hours, at the close of which both fell dead.

In reply Mr. Pocock remarked that greatly exaggerated accounts of the size, ferocity and strength of the British wild cat had been published. Pennant, for example, recorded one 5 ft. long. The average length from nose to tail-tip is about 3 ft., of which the tail is 1 ft.; but occasionally specimens of about 40 in. long are killed.

The Mitten Crab (*Eriocheir*), a Chinese immigrant into Europe. By Dr. W. T. Calman, F.R.S.

ERIOCHEIR SINENSIS, a crab of the family Grapsidae, for which 'Mitten Crab' has been suggested as an appropriate English name, is an inhabitant of the rivers and estuaries of northern China. It is characterized by the fact that the chelae are clothed with a dense fur of long, soft hair. It breeds mainly, if not exclusively, in the brackish water of estuaries or on the sea coast near the mouths of rivers, and the young crabs make their way up the rivers into fresh water and penetrate inland for great distances, sometimes reaching as much as a thousand miles from the sea. The date and mode of its introduction into Europe are not definitely known, but it is supposed to have been transported in the water ballast tanks of steamers trading with the Far East. A living specimen was found by a fisherman in the River Aller, a tributary of the Weser, in 1912, but it was not until 1923 that the species was identified, and it was then found to be living in considerable numbers in the lower reaches of the Elbe. Since that date it has increased its range year by year and is now found as far inland as Prague, and has spread to the rivers of Holland and the Rhine on the one hand, and to East Prussia on the other. In places it has been reported as interfering seriously with the freshwater fisheries, taking the bait from the hooks and tearing and destroying the nets. It is also said to damage the muddy banks of rivers by its burrows. It is esteemed as an article of food in China, and attempts are being made to popularize its use in Germany both for human food and also for feeding pigs and poultry. It has not yet been found in this country, but in view of its abundance and rapid spread on the Continent its appearance here would not be surprising.

Mr. C. J. SHEN (Visitor) stated that *Eriocheir sinensis* is very popular in China. It is usually found in rivers, canals, and near the shores. Its distribution is rather wide, extending longitudinally along the coast from Liaoning (Tatungkou) down to Fukien (Amoy) and transversely along the Yangtze Valley from Shanghai up to Ichang. It becomes fully grown in autumn and it is highly relished as a food.

In connexion with Dr. Calman's expression of surprise that the crab had not yet appeared in Great Britain, Mr. Pocock, assuming that a freshwater, non-swimming species would be unable to cross the sea from the Continent in the adult condition, asked if there was any evidence that its free-swimming zoea-stage could withstand immersion in salt water sufficiently long to make its way into the estuaries of English rivers.

Dr. G. P. BIDDER asked if it was true that the immigrant

crabs are a serious danger to the banks of canals and waterways in which they burrow.

Dr. C. TATE REGAN said that in fishes the breeding journey of adults was generally against the current, and the young travelled away from the breeding place with the current. He asked whether a downstream migration of adults, and upstream migration of young, was common in Crustacea.

In reply to Mr. Pocock's question Dr. CALMAN said that not much was known of the conditions of life of the earliest larvae, but it was likely they could live in the sea. Their transport to the British coasts would probably be difficult since the general set of the currents in the southern parts of the North Sea was from west to east, but the adult animals might possibly be carried across clinging to the bottoms of ships or barges.

**The 'Wallacea' Region and the Great Lakes of Celebes.
By Dr. Richard Woltereck (Ankara).**

[Abstract.]

IN 1931 Dr. Woltereck visited a great number of lakes in North-Eastern America, California and Hawaiian Islands, in order to compare the endemic differentiation of animals within these 'biotopes' with the same in European post-Glacial lakes. In 1932 he visited, together with Dr. Willis Tressler (Buffalo University), the Philippine Islands, Luzon, Mindoro, Leyte, Negros, Mindanao, Jolo, and Cagayan Sulu, these islands forming the northern part of the 'Wallacea-region' (Merrill and Dickerson) between 'Sunda-land' and 'Papua-land'.

The very many lakes, most of them of volcanic origin, within this 'unstable region' (Merrill) contain an interesting material, not yet investigated, for the *genetical study of local differentiation*. Some of the populations of these lakes are rather young ones, arising after volcanic eruptions in historical times, others are of early Pleistocene age; some are deep and large (for instance, Taal Lake), others small, others shallow and very hot. Some are situated in the dense forest of high mountains, others in the open lowlands. The majority of the Philippine lakes are small, circular bodies of water, rich in life in a narrow upper layer, but without any life except bacteria in the waters below.

Later the expedition visited ten of the small islands between Mindanao and Celebes, especially Groot Sanghir, Siaoe and Makalehi, with interesting lakes and streams. During some other months the lakes of Celebes have been investigated, situated in the northern province Minehassa, in the south-western region and in the central forests of that 'anomalous island' (Wallace).

The large lakes Matano (590 m. deep), Mahalona, Towoeti, and a group of smaller lakes in the same region have been found most interesting. Towoeti Lake, for instance, contains, besides some endemic genera and species of fishes and snails (found already by the Sarasins), a peculiar kind of microscopic life not investigated before. These great lakes are of tectonic origin and rather old; the water is very warm and clear (transparency, measured by the white disk, about 24 m.). The expedition found two new lakes, called by the natives 'Timo-booë' and 'Timo-aré'. In these and the other Celebes lakes a number of unknown species of shrimps, Copepoda, Phyllopoda, &c., have been discovered; the same applies to some lakes of the Philippines, and of Bali, Java, and Flores, visited later by the same expedition.

In general the differentiation of *species* in these warm lakes is in many cases rather astonishing; for instance, there are more than twenty endemic Cyprinids in Lanao Lake (Mindanao), described first by Herre some years ago, and comparable to the about sixty endemic Cichlids in Victoria Lake, discovered by Graham and Worthington.

On the other hand, the differentiation of local *races* (subspecies) in these warm lakes—for instance, of pelagic Entomostraca—is very much less pronounced compared with the development of thousands of endemic inheritable races in the temperate lakes of North America and Europe. Dr. Woltereck believes that this surprising phenomenon can be explained by the *difference of 'genetical age'* (=number of generations) in cool and warm bodies of water of the same geological age. An article on his experience and theory will be published later in 'Nature'.

LITERATURE.

- GRAHAM & WORTHINGTON. Report on the Fishing Survey of Lake Victoria &c. Crown Agents for the Colonies. London, 1929.
- HERRE. The Philippine Cyprinidae. Philippine Journal of Science. Manila, 1924, 1925 ff.
- MERRILL, DICKERSON, & others. Distribution of Life in the Philippines. Monographs of the Bureau of Science. Manila, 1928.
- WOLTERECK, BREHM, & others. Mitteilungen von der Wallacea-Expedition Woltereck, nr. i-xii ff. Zoolog. Anzeiger, 1933-34.
- WOLTERECK. Races, Associations and Stratification of Pelagic Daphnids in some lakes ... of the United States. Trans. Wisconsin Acad. of Sc., 1932.
- Endemism and the probable primary causes of Organic Evolution. The Philippine Agriculturist. Manila, 1933.
- Artdifferenzierung (insbesonden Gestaltänderung) bei Cladoceren. Zeitschr. für indukt. Abstammungslehre. 1934.

Prof. E. W. MACBRIDE said that he wished to express unstinted admiration of Prof. Woltereck's lecture. He had had the greatest respect for Prof. Woltereck's work ever since

his fundamental research on Annelid development and the metamorphosis of the Trochophore larva: this respect had deepened when Prof. Woltereck had published his observations on the change in character of a Cladoceran Crustacean produced by transporting it from a cold lake in South Germany to Lake Nemi in Italy, and the heritability of this changed character after a sojourn in Lake Nemi for twenty years. Prof. MacBride cordially agreed with Prof. Woltereck in his statement that the evolutionary changes deducible from a study of the recent fauna of post-Glacial lakes were such as could not be explained by 'gene-mutations'. In his opinion mutations had played no part in evolution at all. He was discouraged, however, by Prof. Woltereck's conclusion that the time which had elapsed since the close of the Glacial Age had only sufficed for the production of new *races*—that for the origin of recent species we had to go back to pre-Glacial times, possibly 200,000 years ago. It was disheartening to the experimenter to be told that he had to live to the age of 10,000 years before he could produce even a new race.

Dr. E. B. WORTHINGTON expressed great pleasure at hearing the lecture, since it was a first personal contact with Dr. Woltereck, one of the leaders in the science of Limnology. Many of the problems which the lecturer had outlined for the lakes of 'Wallacea' and the northern hemisphere, especially those connected with the differentiation of species, had their counterparts in the lakes of Equatorial Africa. Here, on the opposite side of the tropical belt, a system of dating by correlating pluvial periods with glacial periods is becoming established, which tends to prove that the endemic faunas of such lakes as Victoria Nyanza and Edward Nyanza, to which Dr. Woltereck had referred, have been evolved *in situ* since the Ice Age, i.e., during about the last 15,000 years. A detailed ecological and experimental study of the endemic *Haplochromis* spp., such as Dr. Woltereck is now carrying out for Cladocera in the northern hemisphere, might direct another spot-light on the process of evolution.

Prof. R. R. GATES suggested that as the climatic conditions of North America, including Michigan and Wisconsin, showed much greater seasonal variation than those of Celebes, this might account for the greater variability of the organisms in lakes of the former region than in those of the latter. He recognized, however, that this could not be the whole explanation, for it was clear from systematic and other work that some species showed great natural variability, while related species or groups in the same environment were relatively constant. This mystery of the differing capacities for germinal variations or mutations exhibited by different species had never yet been solved.

Prof. WOLTERECK replied.

The following papers were read in title :—

‘*Peucedanum* and *Steganotaenia* in Tropical Africa.’

By CECIL NORMAN, F.L.S.

‘A revision of the South African species of *Juncus*.’

By Prof. R. S. ADAMSON. (Communicated by the BOTANICAL SECRETARY.)

15 MARCH 1934

Dr. W. T. CALMAN, F.R.S., Vice-President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 1 March 1934, having been circulated, were taken as read and confirmed.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Frances Lotte Stephens, Valentine Jackson Chapman, Harold George Fisher MacDonald and Norman Ingram Hendey.

Certificates of recommendation of the following candidates for Fellowship were read :—For the second time, in favour of Paul Westmacott Richards and Ernest James William Barrington ; for the first time, in favour of Theodore Edward James, Gordon Wright, and Dorothy Bexon.

Some interesting British Sorbi.

By Mr. A. J. Wilmott.

THE three main species of *Sorbus* in the British Isles, as in north-western Europe generally, are *S. Aucuparia* (the Mountain Ash), *S. torminalis* (the Wild Service Tree), and *S. Aria* (the Whitebeam). Hybrids certainly occur in the genus, and many of the plants intermediate between these species have at times been regarded as hybrids. The first two species are little variable compared with *S. Aria*, which is extremely variable even when, as on Box Hill, it is clear that the variation is not due to the hybridization of two closely allied forms. In addition to this variability, *S. Aria* has close allies which are not intermediate towards either of the other main species, but which must be regarded as subspecies of *S. Aria* or as separate closely allied species. *S. rupicola* (Syme), in addition to its well-marked characters, has a more upland and northern distribution. *S. porrigens* Hedlund is less obviously distinct, but in addition to its smaller basally entire and cuneate leaves, seems to have pink anthers and a smaller deep carmine fruit with few but conspicuous spots (lenticels). If intermediate forms are of hybrid origin between *S. Aria* and *S. Aucuparia* or

S. torminalis, it may be difficult to determine which of the *S. Aria* allies was the parent.

The first intermediate between *S. Aria* and *S. torminalis* to receive a name was *S. latifolia* (Lam.) Pers., a plant common in the Forest of Fontainebleau. This plant, like many other intermediates, comes true from seed, and cannot be a simple hybrid. But the name has been used generally for intermediates between *S. Aria* and *S. torminalis*. Plants so named in this country occur in the south-west of England north to Symonds Yat in Gloucestershire and Herefordshire. They occur always within the area of distribution of *S. torminalis*. Examination of a large amount of material shows that they are not uniform. The plants of Cornwall and Devon generally have a very large heavily lenticelled fruit, and leaves with commonly square or cordate base and mostly shallow rounded-margined lobes. But at Watersmeet there is considerable variation, the fruit is often smaller, and the leaves may be narrower with more cuneate base, or with sharper, more triangular lobes. I have not had opportunity for studying these alive.

In the Avon Gorge at Bristol another very different form occurs. There are many trees, occurring both sides of the gorge, all uniform and unlike all other forms I have seen. It has light green thinnish tough leaves with shallow lobes in the upper half, of the distinct form illustrated. The fruits are orange-brown as in all forms of *S. latifolia*, and are of two distinct sizes on each plant, smallish and small.

At Greenaleigh, near Minehead, another form occurs with narrower leaves, with more and deeper sharper lobes and sharply triangular apex. Although various names (*intermedia*, *scandica*, *latifolia* var. *decipiens*, *rotundifolia* var. *decipiens*) have been given to these plants, they are all uniform, and again unlike plants from any other locality.

Neither of these forms is the same as the Fontainebleau *latifolia* and, so far as I can determine without seeing Bechstein types, neither is *decipiens*. They are uniform lineages which must be given new names.

The '*S. latifolia*' of the Wye Valley at Chepstow (Piercefield Park) and Symonds Yat are yet another form. A cluster of trees a little south of the Yat top are quite uniform, showing again that this plant reproduces itself from seed, and requires a name.

The 'intermediates' between *S. Aria* and *S. Aucuparia* show the same phenomenon of isolated very local distinct forms. Some of the intermediates are common and widespread, e.g. *S. intermedia* (Ehrh.) Pers. (*S. scandica* (L. as var.) Fries), which is commonly planted or self sown, but not native; forms with free pinnae at the base of the leaf, such as *S. hybrida*

L. (*S. fennica* (Kalm) Fries), widespread in Scandinavia, and other forms intermediate again between this and *S. Aucuparia*. The first native plant of this group to be discovered occurs in the mountains in the north of Arran. Two forms grow there: one approaches *S. scandica* Fr., with which it was formerly identified; the other, intermediate between it and *S. Aucuparia*, is near *S. fennica*. These two were together named *S. arranensis* by the monographer of the genus, Hedlund, in 1901, but after seeing more material he accepted the second as being *S. fennica*. After seeing many specimens I do not think it identical with the Scandinavian *S. fennica*, and consider that it must have arisen from *S. arranensis* and *S. Aucuparia*. Hedlund accepts specimens from several Norwegian localities as being *S. arranensis*, but none of the few Norwegian specimens I have seen is identical with any of the numerous uniform series seen from Arran.

Another very distinct plant is *S. minima* (Ley), confined to the Limestone rocks of the Mynydd Llangattwg above Crickhowell in Brecon, with narrow shallowly lobed leaves and small brilliant red fruits.

Another, also from Brecon, is confined to a similar small precipice above Dan-y-graig. This has been referred to *S. scandica*, but is again quite distinct. A visit to the locality showed that there are many small bushy trees of it, all identical, growing with numerous *S. rupicola*, *S. Aucuparia*, and one or two *S. Aria*. It also requires a new name (*Leyanus*).

Herbarium material indicates that there are in Wales yet other peculiar specimens of the same affinity which will presumably prove to be uniform and equally restricted in area.

Sorbus anglica (Hedlund) is a broader leaved red-fruited plant known from Somerset (Cheddar), Monmouth (Piercefield) and on the other side of the river in Gloucestershire (Tidenham), Herefordshire (Gt. Doward) and Montgomeryshire (Breidden); I have recently seen a specimen from Kerry (Killarney). It was originally placed as a variety of *S. Mougeoti*, a plant of the Jura, and it is certainly very near to it, though not identical.

How should these forms be treated taxonomically? They are not simple hybrids; they are too uniform and they come true from seed. If they have arisen by doubling of chromosomes from an original cross one would expect more of them, for they have been long in the localities in which they occur. Field work indicates that hybrids, though not very common, are not very rare in this genus. But if they are tetraploids one would not expect the two sizes of fruit shown at Bristol and Greenaleigh, and even on a plant of *S. Aria* observed near Bristol. If the cause of pure breeding were apogamy or parthenogenesis I should again expect more of these uniform

strains. That they are consequent upon hybridization at some period seems probable, but whether they are still originating or whether they date from inter-glacial or post-glacial times is doubtful. *S. arranensis*, *S. minima*, and *S. Leyanus* may all have resulted from *S. Aucuparia* × *rupicola*, and could be treated as a subspecies under an aggregate *S. arranensis*, but the '*latifolia*' forms cannot be grouped until one knows whether one parent was *S. Aria*, *S. rupicola*, or *S. porrigens*. To group allied forms before their relationships are known only creates confusion, because the groups are continually changing as the forms are moved about from one to another. The rule which I would propose in order to avoid this continual change is:—No taxonomic group should be subordinated to another without definite evidence—preferably cultural or genetical or cytological in closely allied species—which makes it almost certain that the group will not again be raised from its subordinate position. Only in this way can stability in taxonomy be reached, for if this rule were applied all changes would be in one direction and groups would settle into their correct positions as evidence was gradually obtained. I therefore think it best to distinguish these unnamed *Sorbi* as species. They certainly show 'specific difference', i.e. differences in all parts of the plant.

SORBUS BRISTOLIENSIS, sp. nov. *Sorbus* (*Pyrusve*) *latifolia* et var. *decipiens* quoad plantarum bristolensium; holotypus in Herb. Mus. Brit. legi ipse 19 Sept. 1933 no. 3980.

Folia matura petiolis c. 13 mm. longis subcoriacea dilute viridia (inter siccandum flavescentia), supra nihil vel parum nitentia glabra (immutura tomento raro mox evanescenti sparsa), subtus tenui sed denso flaventi-cano tomento vestita, elliptica in medio latissima parva (c. 80 × 55 mm.) lobis infra medium carentia, dentibus hebetibus neque profundis ad basin minime profundis vel nullis; superioris partis lobi, quorum secundus tertiusve (ad 5 mm. altus) ceteros altitudine superat, parum profundi (longitudine altitudinem tribus fere partibus superante); loborum margo qui ad folii apicem vergit plerumque integer rectusque est et ad pares angulos ad folii marginem fertur. Fructus aurantiaci maculis crebris parvis corticeis cinereis distincti; quorum duae formae sunt, altera maior c. 9½–11 mm. longa et lata est, altera minor (? sterilis) 6½–7½ mm. longa et lata (in arbore una c. 8–8½ visa).

Habitat: Avon Gorge at Bristol; Leigh Woods and Clifton Down (Somerset and Gloucestershire). Fruit colour 'orange' by Ridgway's colour standards.

SORBUS SUBCUNEATA, sp. nov. *Sorbus* (*Pyrusve*) *latifolia* et var. *decipiens*, *intermedia*, *rotundifolia*, et *scandica* quoad plantarum e loco 'Greenaleigh near Minehead, Somerset' dictu. Exsicc. Marshall no. 4027 (holotypus in Herb. Mus. Brit.), Barton no. 285.



Single average leaves of (a) *S. vagensis*; (b) *S. subcuneata*;
(c) *S. bristoliensis*; (d) *S. Leyanus*. All $\frac{2}{3}$ nat. size.

Folia matura petiolis c. 22 mm. longis saturate viridia supra sat nitida glabra (immatura tomento raro et tenuissima mox evanescenti sparsa), subtus sat sparsim flaventi-cano-tomentosa, subelliptica (c. 100×60 mm.) nec procul a medio latissima apice triangulari vel subacuminato (angulo c. 90°), de lobo infimo cuneata marginibus rectis vel subconvexis (raro ad basin magis convexis eoque minus cuneata). Partes duae vel tres quintae inferiores lobis carent; dentes hebetiores sunt paulo minus profundi quam lobi, deorsum mox diminuntur vel nulli sunt; lobi quorum secundus altissimus est sat patuli sunt et acuminati (longitudine altitudinem tribus partibus superante). Fructus fructibus *Sorbi bristol.* similes maculis autem corticeis minus crebris; his etiam duae formae sunt formae, quarum minor sterilis.

Marshall's no. 4026 from the same locality, with leaves often slightly narrower, often more cuneate below and with slightly whiter tomentum beneath, may prove inseparable, or a back cross with *S. rupicola*, or possibly of independent origin. *S. subcuneata* may be presumed to have arisen from *S. rupicola* and *S. torminalis* (or the Devon form of '*S. latifolia*').

SORBUS VAGENSIS, sp. nov. Holotypus in Herb. Mus. Brit., legi ipse 1933 no. 4492.

Folia matura petiolis c. 25 mm. longis, saturate et laete virentia sat nitida, supra glabra subtus tenui nec denso (est ubi tomentum sparsum est) flaventi-cano tomento vestita, ovata paulo infra medium latissima, apice triangulari vel subacuminato (c. 110×85 mm.) ad basin curvata et in petiolum cuneato-decurrentia breviter (nonnulla autem ad tertiam partem inferiorem cuneata marginibus rectis vel concavis). Duae partes tertiae superiores lobatae; loborum secundus altissimus (ad 9–12 mm.). Dentes plerumque in mucronulum saepe patentem exeunt, basin tamen versus minores vel nulli sunt. Fructuum fructibus *Sorbi bristol.* duae sunt formae similes, paulo longiores quam latiores subovoidei, maculis multis corticeis sat parvis sparsis.

Habitat: Gloucestershire: Symond's Yat; type from the large tree just inside Mrs. Harris's tea garden. A cluster of small trees by this large tree are uniform and like their presumed parent: *S. vagensis* therefore doubtless comes true from seed. If slightly varying specimens from the Wye Valley all belong to *S. vagensis* it occurs in Monmouth (Piercefield Park and the Wynd Cliff) and Herefordshire (Gt. Doward). *S. vagensis* may have arisen from *S. torminalis* and either *S. anglica* or *S. porrigens*.

SORBUS LEXANUS, sp. nov. Holotypus in Herb. Mus. Brit. e loco 'above Dan-y-graig near Merthyr Tydfil, Breconshire' dictu, legi ipse 1933 no. 4088.

Folia petiolis c. 15 mm. longis, saturate et laete virentia, supra glabra (immatura tomento rarissimo sparsa) subtus tenuiter (ad venas maiores dense) albo-tomentosa, ovato-elliptica (c. 100×70 mm.) infra medium latissima apice late triangulari vel curvato-obtuso, de infimo lobo cuneata margine rectiusculo vel concavo; lobi partis infra medium jacentis profundi quorum infimus paene (raro usque) ad nervum principalem incisus et saepe extrorsum curvatus. Fructus coccinei vel rubro-coccinei, sphaerico-ovoidei vulgo paulo latiores quam longiores ($8 \times 8\frac{3}{4}$ mm.), maculis corticeis minutis rarisque.

A considerable number of plants on a single short rock-face, quite uniform and presumably arisen from *S. Aucuparia* and *S. rupicola* growing there. The nearest ally I have seen is a plant from Bindalen (Nordland: Norway) named '*S. arranensis* Hedl. (*S. neglecta* Hedl.) det. Hedlund'. The fruits are 'scarlet' or 'scarlet-red' by Ridgway's standards. It has been distributed by A. Ley as *P. scandica*? The locality is some distance from Cefn Coed.

Observations on the formation, development, and structure of the tuber of *Testudinaria elephantipes*, and on the vegetative shoot. By E. N. Sparshott, M.Sc. (Visitor).

THE investigations were carried out on young plants of *Testudinaria elephantipes* grown from seed collected in January 1927 by Prof. E. L. Watkin from plants growing on the Southern Karroo.

The adult tuber of *T. elephantipes* is semi-globular, with a flattened or concave base from which roots arise centrifugally. Except at the apex, the surface of the tuber is covered with cork, thin over the base, but thick and deeply fissured elsewhere owing to internal growth. Each season one or more climbing vegetative shoots develop in the axil of one of the scale leaves which surround the apex of the tuber.

The embryo shows no tuberization. The plumule remains short and bears one relatively large leaf. Assimilates accumulate in the hypocotyl which undergoes tuberization. Early thickening results from the division and hypertrophy of existing parenchymatous cells. Tuberization is continued by secondary growth mainly from a pericyclic 'growth-zone', but also from successive phellogens. The 'growth-zone' assumes the shape of an inverted cup with a hole in the bottom, i.e. beneath the apex of the tuber. Apex and base are further developed from the surrounding meristem, and respectively produce a sympodium with reduced internodes and fibrous roots.

Adventitious buds may develop when the apex is damaged or removed or when a fissure penetrates beneath the 'growth-

zone', and causes its cells to collapse in that area; conditions thus brought about are comparable with those obtaining at the tuber apex.

Dr. A. B. RENDLE, commenting on the interest of Miss Sparshott's investigations, referred to a large specimen which was on exhibition in the Botanical Gallery of the British Museum (Natural History) and which might repay examination. He asked whether an indication of the age of the tuber was possible from examination of the layers in the persistent cork envelope.

Dr. E. N. MILES THOMAS also spoke.

Mr. W. C. WORSDELL said it was one of the most important and interesting morphological and anatomical papers he had ever listened to in that room, and congratulated the author. As the tuber originates partly from the epicotyl and partly from the hypocotyl, it is obviously of *stem-nature*. This is important, as some botanists are disposed to regard the tubers of Dioscoreaceae as organs *sui generis*. He stated there was a specimen of the plant in flower at Kew.

Mr. J. RAMSBOTTOM complimented the lecturer on the very clear way in which she had described her results and had occupied to the minute the time for which she had asked and had been allotted in the program.

Dr. W. T. CALMAN (Vice-President in the Chair), in introducing the following joint communication, stated that plans were under consideration in America for establishing nature reserves in the Galapagos Islands and that the Council of the Society was in communication with the Carnegie Institution of Washington on the subject:—

On the need for the preservation of the Galapagos fauna.

Reptiles. By Mr. H. W. Parker.

THAT there is urgent need for the preservation of the herpetological fauna of the Galapagos Islands is attested by the fact that, of the thirty-eight to forty species of reptiles which have been recorded, four have been exterminated, six others are exceedingly rare, and others again are either extinct or greatly diminished in numbers on islands where they were formerly abundant (see Table, p. 81). This depletion of the fauna is almost certainly due to man's activities and to the predatory commensal and domestic animals which he has introduced into the archipelago. It follows that no attempt to preserve the fauna can hope to be successful unless adequate protection against man's depredations can be enforced and unless measures can be taken to control the pests which he has introduced. Enactment of the necessary legislation to restrict commercial exploitation, and even its enforcement,

[illegible]

ought not to present insuperable difficulties ; the islands are too far from any large centres of population, and the profits to be made are not likely to be large enough to encourage organized poaching. The control of the introduced pests (pigs, dogs, cats, and rats) is, however, a more difficult problem owing to the inaccessible nature of the interior of many of the islands.

Fortunately, however, some islands are still free from these pests, and it seems probable that the establishment of nature reserves might do much to preserve certain elements of the native fauna ; an analysis of the distribution of the various species suggests certain possibilities. So far as the reptile fauna is concerned, the archipelago can be subdivided into three rather arbitrary divisions—a northern group of five islands with a meagre fauna, a central group of eight principal islands with their subsidiaries, and a southern group, Charles and Hood, together with their fringing islets. The northern group (Culpepper, Wenman, Abingdon, Bindloe, and Tower) does not appear to have suffered from man's depredations so much as the others, and its fauna seems to be in no immediate danger ; most of the islands appear to be free from pests.

The reptile fauna consists of Giant Tortoises (*Testudo* spp.), Marine Iguanas (*Amblyrhynchus*), Land Iguanas (*Conolophus* spp. and *Tropidurus* spp.), Geckoes (*Phyllodactylus* spp.), and snakes (*Leimadophis* spp.), and up to the present it is only the commercially valuable tortoises and larger lizards (*Amblyrhynchus* and *Conolophus*) which appear to be in any danger. The smaller reptiles (*Phyllodactylus*, *Tropidurus*, and *Leimadophis*) are not likely to be of direct economic importance to man, but any further spread of the introduced pests may endanger them. This contingency could be guarded against to some extent by the formation of nature reserves on the small, barren islets such as Brattle and Seymour in the central group and the two Gardners in the southern area. These islets are unlikely to be of commercial importance : they are probably free from pests and they harbour most of the indigenous reptiles which occur on the neighbouring, larger islands. The same islets might also be of considerable value in aiding the re-establishment of the larger lizards *Amblyrhynchus cristatus* and *Conolophus subcristatus*, whose numbers have already been seriously reduced and which are probably in danger of extermination owing to the fact that they provide skins valuable for leather-making ; the Government of Ecuador was reported in 1928 to have granted a concession for their exploitation.

Unfortunately reserves on these small islands would not assist in the preservation of the Giant Tortoises, which are

in greater danger than any other elements of the fauna. The species which inhabited Abingdon, Barrington, and Charles are known to be extinct, that of Chatham is also believed to be extinct, and the tortoises of Narborough, James, Jervis, Duncan, and Hood have probably been reduced below that minimum level beyond which a species cannot recover unaided. On Albemarle alone are tortoises still to be found in any numbers, though precisely how many species occur there is a matter of controversy. An interesting attempt has recently been made to prevent the extermination of these Albemarle tortoises by the establishment of colonies in other parts of the world where climatic and other conditions might be expected to be suitable to their requirements. An expedition under the auspices of the New York Zoological Society collected 180 specimens in South Albemarle, and colonies were formed in different parts of the southern United States, in Bermuda, Panama, and Sydney. The majority of these specimens flourished in their new homes, but three years after their transportation no reports of propagation had been received. More recently it has been suggested by Dr. Townsend that the problem might be solved by the formation of a reserve on Charles Island and the introduction of a stock of tortoises from Albemarle. Charles Island, it is said, is suitable for such a purpose on account of its small size, which would render control of the pests practicable, the presence of water, and the fact that it formerly supported indigenous tortoises in large numbers. Among the islands of the Indian Ocean (Seychelles and Mascarenes) Giant Tortoises have been transported from place to place and have bred freely in a state of semi-domestication, so that it certainly seems probable that breeding colonies could be established on suitable reserves within the Galapagos Archipelago. But it is sincerely to be hoped that, if any such scheme is put into operation, every effort will be made to avoid a repetition of events such as occurred in the Indian Ocean: there the tortoises were transported quite indiscriminately and hybridization has taken place to such an extent that it is now impossible to ascertain how many species there may have been, or their original habitats. Much information is still needed, particularly concerning the changes accompanying growth and age, before the specific status of many of the Galapagos tortoises can be satisfactorily settled, and it is essential that breeding colonies should be established from stocks of undoubted purity. At least five 'species' have been reported from Albemarle, and there is still much doubt and confusion concerning them. As an instance it may be mentioned that the large series from which it was hoped to establish breeding colonies in other parts of the world were obtained from a

locality in which two so-called species are said to exist; all the 180 specimens were at first referred to one of these, then to the other, and were also described as belonging to yet a third, new, species. The progeny of such a stock is likely to increase, rather than diminish, the present confusion, whereas healthy breeding colonies of pure and certain ancestry afford the only hope of our ever being able to solve some of the problems offered by these rapidly disappearing animals.

PAPERS CONSULTED.

- BEEBE. 1924. Galapagos, World's End (New York and London).
 BROOM. 1929. *Zoologica*, ix, 8, pp. 313-320.
 GRANT. 1928. *Bull. N.Y. Zool. Soc.* xxxi, 5, pp. 147-148.
 ROTHSCHILD. 1915. *Novitates Zoologicae*, xxii, pp. 403-417.
 ———. 1915. *Novitates Zoologicae*, xxii, pp. 418-442.
 ———. 1928. *Proc. Zool. Soc. London*, pp. 658-660.
 SCHMIDT. 1930. In Schurcliff, *Jungle Islands*, Appendix, pp. 280-285 (New York).
 DE SOLA. 1929. *Copeia*, pp. 54-55.
 ———. 1930. *Copeia*, pp. 79-80.
 TOWNSEND. 1928. *Bull. New York Zool. Soc.* xxxi, 5, pp. 148-169.
 ———. 1930. *Bull. New York Zool. Soc.* xxxiii, 4, pp. 134-155.
 ———. 1930. *Bull. New York Zool. Soc.* xxxiii, 4, p. 170.
 ———. 1930. *Zoologica*, ix, 13, pp. 460-474.
 ———. 1931. *Bull. New York Zool. Soc.* xxxiv, 6, pp. 180-181.
 VAN DENBURGH. 1907. *Proc. Cal. Acad. Sci.* (4) i, pp. 1-6.
 ———. 1912. *Proc. Cal. Acad. Sci.* (4) i, pp. 323-374.
 ———. 1912. *Proc. Acad. Sci.* (4) i, pp. 405-430.
 ———. 1913. *Proc. Cal. Acad. Sci.* (4) ii, 1, pp. 133-202.
 ———. 1913. *Proc. Cal. Acad. Sci.* (4) ii, 1, pp. 203-774.

On the need for the preservation of the Galapagos fauna.

Birds. By Mr. P. R. Lowe.

ONE of the strong points Mr. Parker has advanced in favour of the acquisition of one or more of the islands for the purpose of treating them as zoological sanctuaries was the very regrettable fact that the island lizards were being commercially exploited.

Even if actual extinction did not result, the balance of nature was bound to be upset. They all knew what commercial exploitation entailed if not properly controlled, and under present circumstances it was very difficult to see how adequate control could be properly exerted.

Happily, in the case of the birds of the Galapagos there was little fear of their exploitation on the part of plumage hunters, for their plumage, especially that of the Ground Finches, was of such a character as to preclude the idea of commercial enterprise of this sort. A good deal of harm, however, had been done already in the direction of upsetting the old natural balance, by the introduction of plants and domestic animals, as well as by experimental efforts to

establish plantations which were almost inevitably foredoomed to failure.

On the other hand, in regard to the destruction of indigenous trees, I may give, as an example of what is going on and what might be expected, the case of the valuable Orchill lichen (*Rocella*). This lichen gives a beautiful purple dye and grows on trees in the more elevated and humid parts of the islands. To save themselves trouble the people who come over from Ecuador to gather it simply cut the trees down. It went without saying that such forms of improvident folly must inevitably have their reactions on the bird life of the islands.

In stating the case for the birds, however, I propose to limit my remarks to the consideration of the very extraordinary diversity which exists in the Ground Finches (Geospizids) and to the no less remarkable conditions which obtain in regard to their distribution on the islands, for this distribution is almost as extraordinary as the diversity.

As regards these finches, I venture to think that we had awaiting our attention an evolutionary mystery or a biological problem of first class importance, and that this problem alone would justify the establishment of biological reserves on one or more of the islands. In point of fact, all my forthcoming remarks are aimed at this happy possibility and the urgent case these finches present for biological research carried out on the spot.

Several outstanding features make this group of finches both interesting and difficult to explain. There are altogether 89 resident breeding birds on the Galapagos, of which 37 forms belong to the Geospizids. They may, therefore, be said to be the dominant group of land birds. As far as birds are concerned, the Galapagos may be divided into nine rather large islands centrally situated and eleven quite small ones scattered at varying distances from the central group. Some, like Culpepper and Wenman, are distant as much as 80 miles or more. On every one of these twenty islands, large or small, Ground Finches are found.

Many attempts have been made by leading ornithologists to systematize the various so-called species and subspecies, which constitute a very bewildering group. No agreement has been reached. For example, as regards genera, Rothschild and Hartert group the entire community under one single genus—*Geospiza*. At the opposite extreme Swarth, the author of the last important monograph on the 'Birds of the Galapagos', holds that there are five genera. It will, therefore, be obvious at once that even if we regarded Swarth's five genera as more probably representing five species, there would evidently be great difficulty in defining their limits,

so great must have been the intergradation found by Rothschild and Hartert with even far less material to work on than was examined by Swarth.

As regards species, Swarth has based his opinions not only upon the enormous collections made by the California Academy of Sciences, but he has made a personal examination of all the chief collections in the United States of America, of those contained in the British Museum, of those at Tring and Paris, and of various continental museums too numerous to mention, a mass of material which has probably never been exceeded in any one group.

He tells us that no less than 67 specific and subspecific names have been bestowed upon various forms of these finches, and that he regards 40 of these as being valid. Accepting Mr. Swarth's rejection of 27 specific and subsequent names as being untenable for one reason or another, we are, therefore, faced with the most unusual distribution of forty forms among twenty islands, large and small.

But this is not all. Some of the larger islands, as for example James, Charles, and Indefatigable, have as many as ten or eleven different forms upon them; the little Wenman, 78 miles from the nearest point of Albemarle, has six (divided into three genera); while on Duncan, with an area of only 10 square miles, we find no less than ten different forms (comprised in five genera) herded together.

It is also to be noted, and this is important, that these various so-called specific forms are not confined to single islands. For example, one species, *Geospiza strenua* of authors, is found on eleven different islands. Moreover, there is great diversity even within the limits of any given form. Rothschild, for instance, has figured sixteen different forms of diversity in the bills of this form obtained in six different islands.

Such diversity and such a distribution in an island group of this nature is unparalleled as far as existing birds are concerned. Diversity in any given genus in island groups of this nature is, of course, well known; but I think it is safe to say that it is rare to find more than two species of resident breeding birds belonging to the same genus occupying the same island. What generally happens in an island group, as for instance the West Indies, is that each island or group of islands has its own peculiar species or subspecies, those of the genera *Coereba*, *Euethia*, and *Loxigilla* being cases in point, the only exception I can recall being in Cuba, where we find the genus *Territristis* with two species, one at either end.

The differences in form and size of the bills in the Geospizids of the Galapagos present a puzzle of intergradation which has been the despair of systematists. Rothschild and Hartert have figured thirty-five different forms on one plate. These

differences in size and shape constitute the principal form the diversity takes; but with this is correlated nearly as much diversity in coloration and in the size, weight, and form of the body.

The coloration is dull and on the whole characteristic of juvenility. It is a vague and uncertain character on which to build and there is the most embarrassing intergradation. Colour-pattern, too, is far from being a striking feature of the plumage.

Melanism again is another factor which seems to have played a prominent part in making the systematist's task more difficult. I found melanism a very striking feature among the small finches of the genus *Euethia* which I discovered in great abundance on an arid cactus-grown island named Blanquilla in the Caribbean. The physical conditions of Blanquilla must be very similar to those of the Galapagos, and it seems very probable that in the genus *Euethia* we have the nearest relation to the Geospizids. I find that the males of *Euethia bicolor johnstonei* on Blanquilla are so like those of *Geospiza fuliginosa minor* of Bindloe Island (Galapagos) that, if mixed in a box, even an expert would have difficulty in picking them out.

Systematists have tried to classify the Geospizids on the form of the bill combined with the diversity in coloration. Hundreds, if not thousands, of their skins have been collected for this purpose. Rothschild and Hartert have said ('Novitates Zoologicae'): 'If such collections are not sufficient to throw any light on the problem . . . no collection (of skins) will ever do so'. I think it may be conceded that such collections, indispensable as they have been for demonstrating the diversity existing, will never solve the problem waiting to be solved.

The correlation of food and other environmental factors with the amazing diversity obtaining in these finches has also failed to throw light on the problem. Beebe, from personal observations, has stated that 'birds utterly dissimilar in relative proportions of bills were feeding upon identical food'. He speaks of these islands as 'a mad country for birds'. The physical conditions, too, and general features of all the islands are remarkably similar. Isolating factors are far from being obvious or convincing.

How then are we to account for the phenomena exhibited? I do not propose to answer that question, nor could it, in my opinion, be answered except by the acquisition of one or more islands to be treated as strict reserves, by conducting genetical experiments on the spot, and by close and long continued observations in the field of the breeding habits of as many forms as possible. Such researches could only be successful by setting up a biological station.

I would, however, like to hazard the suggestion either that (1) hybridization has been going on among these finches on a scale quite unknown elsewhere ; or (2) that in the past the segregates of a cross between ancestral forms had been distributed over a large insulated area which had subsequently been broken up by local submarine subsidences or by local volcanic upthrusts leading to the present disposition of the islands.

Finally, I might add that I have called attention (Ibis, 1923, pp. 521-3, and Bull. B. O. C. 1930, vol. i, p. 27) to the remarkable fact that diversity occurs in the case of the finch genus *Nesospiza* on Nightingale Island, one of the Tristan d'Acunha group, which is very suggestive of the condition found in the Galapagos. In 'The Ibis' I have figured the heads and wings of two 'species' which live side by side.

Dr. R. GUNTHER recalled the very great interest which his father had taken in the preservation of the Gigantic Land Tortoises, which already, when the *Herald* visited the islands in 1846, were reported in danger of total extermination by man. He exhibited Dr. A. Gunther's original drafts of a Memorial addressed in 1872 to Sir Arthur Gordon, K.C.M.G., Governor of the Mauritius, in which attention was drawn to the jeopardy in which the tortoises there then were, and to the urgent need of some reserve where they could be protected as the property of the Colony. From this same document he quoted the case of the Galapagos tortoises, 'now also fast disappearing'. The Memorial was signed by the Presidents of the Royal and Royal Geographical Societies, by Sir Richard Owen, Charles Darwin, the Professor of Comparative Anatomy at Cambridge, and by Dr. A. Gunther. The Memorial was used again in 1883, and to Dr. Gunther's action the preservation of the Giant Tortoises of the Mascarenes, though in much diminished numbers, is principally due.

Mr. J. RAMSBOTTOM said that zoologists could always depend upon the support of botanists in any effort they made to establish nature reserves, for it was obvious that undue interference with a native fauna had a deleterious effect on the native flora. The introduction of pigs and goats had ruined several island floras and it was to be hoped that the pigs mentioned by Mr. Parker would be kept properly domesticated. The statement made by Mr. Lowe about the cutting down of trees to obtain lichens for dyeing was very disturbing, for the indiscriminate felling of trees was also a sure way of wiping out a good many species of herbaceous plants and generally upsetting the balance which previously existed.

The flora of Galapagos is an interesting one. Darwin, though he visited the islands for a very short time in a dry period, obtained 201 different plants. When J. D. Hooker

described these and a few added small collections he found 107 new to science out of 239, i.e. 45 per cent. Several of these species have since been found on the American continent ; but it is an interesting fact that although the number of species, varieties, &c., has been constantly added to, the percentage of endemics remains practically what it was in Hooker's original account ; thus B. L. Robinson (Proc. Amer. Acad. Sci. xxxviii, no. 4, 1902) gives 236 forms out of 531, i.e. 44.4 per cent. for flowering plants, though only three out of nineteen ferns are endemic—a small percentage probably holds for all cryptogams.

An account of the ecological conditions of the islands is given by Alban Stewart in Proc. Calif. Acad. Sci. i (1911) pp. 7-288.

Dr. A. B. RENDLE remarked on the importance of measures for the conservation of the flora of the islands, which include a large and interesting endemic element. The uncontrolled introduction of domestic animals, and especially the indiscriminate felling of trees, was to be deprecated. There seemed to have been less danger of the extermination of native species by the introduction of alien plants than had been the case in other oceanic islands such as St. Helena and the Bermudas, where the original vegetation had been almost completely destroyed or its aspect greatly changed by alien introductions.

Mr. W. S. ROWNTREE said that the crux of the problem seemed to be the introduction of non-indigenous creatures, which preyed upon or competed unfairly with those native to the islands. Dogs, cats, rats, and pigs had been specially mentioned. He suggested that probably these pests destroyed especially the young and the eggs of the birds and reptiles, and instanced the authentic case of the island of Mauritius, where the Dodo is said to have been exterminated largely through the destruction of eggs and young by the introduced pigs.

Mr. PARKER replied to questions.

The following paper was read in title :—

'Further notes on the genera *Fumaria* and *Rupicapnos*.—III.' By H. W. PUGSLEY, B.A., F.L.S.

12 APRIL 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 15 March 1934, having been circulated, were taken as read and confirmed.

Issued 21 September 1934]

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A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Stanley Thomas Burfield and Cedric Errol Carr.

Certificates of recommendation of the following candidates for Fellowship were read :—For the second time, in favour of Theodore Edward James, Gordon Wright, and Dorothy Bexon ; for the first time, in favour of Patrick Martin Hall.

Certificates of recommendation of the following candidates for Foreign Membership were read for the first time :—Camille Sauvageau and Otto Rosenberg.

In accordance with Chap. X Sect. VII of the Bye-Laws, the following Fellows were elected, by show of hands, as Auditors of the Treasurer's accounts for 1933-34 :—

Representing the Council : Mr. N. B. Kinnear
Miss E. M. Wakefield

Representing the Fellows : Mr. H. W. Pugsley
Mr. D. J. Scourfield

The President reported the deaths of Professor S. H. Vines, F.R.S., and Dr. L.-L. B. de Beaumont, Fellows of the Society ; and moved the following Resolution, which was passed in silence, all standing :—

The Fellows of the Linnean Society of London have heard with great regret of the death of Professor SYDNEY HOWARD VINES, F.R.S., who joined the Linnean Society in 1878 and had therefore been a Fellow for over fifty years. As Sherardian Professor of Botany in the University of Oxford he rendered great services to that University and by his researches particularly in the domain of Plant Physiology contributed much to the advance of Botanical Science. The Society desires to put on record its high appreciation of his services to Science and its grateful remembrance of his active interest in the work of the Society, in particular during the period in which he occupied the Presidential Chair, 1900-1904.

The Fellows of the Society desire to express to Mrs. Vines and her family their deep sympathy with them in their bereavement.

The President announced that the Council had unanimously resolved to award the Linnean Gold Medal for 1934 to Sir SIDNEY F. HARMER, K.B.E., F.R.S.

Deer in Ancient Egypt.

By Mr. Warren R. Dawson (Visitor).

THE lecturer exhibited a series of pictures of these animals from monuments ranging in date from the Predynastic period to the Eighteenth Dynasty. He summarized the opinions of previous writers on the subject who had maintained that the North African race of Red Deer, *Cervus elaphus barbarus*, and an Asiatic species of the Damine group of the family, probably *Dama mesopotamica*, formerly had a much more extensive geographical distribution eastwards and westwards respectively, and that both species once inhabited the Nile valley. There is no positive evidence in favour of such a hypothesis, and much presumptive evidence against it, and it was suggested as much more probable that the Egyptian pictures of deer (which are relatively rare as compared with those of other mammals) were based upon sketches of deer brought home by far-travelled Egyptians who had seen living deer in their own habitat, or possibly sometimes upon living individuals occasionally imported from Asia as curiosities. The extremely conventionalized rendering of the antlers indicates that most of the Egyptian pictures of deer were not made from nature, as they contrast markedly with the very truthful and accurate pictures of antelopes and other mammals with which the Egyptians were familiar.

Major S. S. FLOWER, while appreciating the trouble and care that Mr. Warren Dawson had taken to bring these drawings together, did not consider that they provided conclusive proof of the presence in ancient Egypt of living deer, wild or in captivity.

In a few cases branched antlers appeared to be indicated, but there was the possibility of detached antlers having been imported into Egypt as curiosities from other countries, but in most of the drawings the animal was the Addax Antelope.

The artists appeared to have had difficulty in representing the spiral horns in low relief, and the outer curves of each spiral had come to look like protuberances or tines on the sides of the horn.

The Addax, though now extinct in Egypt (the last wild individual is believed to have been killed about the year 1900, see P. Z. S. 1932, p. 441), appears to have been formerly numerous in suitable parts of the country west of the Nile.

Professor E. W. MACBRIDE said that Mr. Warren Dawson's paper was of extreme interest. He had only two observations to make, viz. :

(1) There was evidence of progressive desiccation of northern Africa even in historic times. When the climate was moister Egypt would be more accessible both to Syrian and Barbary deer than it is at present.

(2) It was not quite correct to say that the Ethiopian region was entirely barren of deer. One small species allied to the fallow deer had penetrated round the west coast as far as Gambia.

Mr. J. L. CHAWORTH-MUSTERS also took part in the discussion ; and Mr. Warren Dawson replied.

Nomina conservanda in zoological teaching.

By Mr. H. R. Hewer (Visitor).

THE Council of the Association of British Zoologists has appointed a small Committee (Prof. E. S. Goodrich, Dr. S. Kemp, and Mr. H. Hewer) to draw up a list of generic names in common usage in zoological teaching departments in Great Britain.

These names, when their application has been adequately defined, would be put forward as *nomina conservanda* on the grounds of common usage in teaching.

The Committee has compiled such a list, taken from University and College syllabuses and from standard textbooks, and has ruled out those names of infrequent usage. The list now comprises some five hundred names and is in the hands of the British Museum (Nat. Hist.) where the various divisions have been distributed for criticism to the specialists on those sections.

The Council of the Association has taken this step because many of the names in very common usage have already been altered and others may soon suffer the same fate. The main changes which they desire to prevent are those of transference and the suppression on the grounds of priority of well-known names which have been current in zoological literature for many years. The sacrifice of well-established and long-used names has resulted in great confusion in literature not primarily dealing with systematics.

Dr. STANLEY KEMP hoped that Mr. Hewer's work and that of the specialists on the staff of the British Museum would lead to the preparation of a list on which zoologists in this country could agree, and that the names would ultimately be accepted by the International Commission on Nomenclature as *nomina conservanda*. Though advance in knowledge must on occasion result in change of name, there was no doubt

that many well-known names had been needlessly abandoned in recent years on pretexts that are not acceptable to the majority of working zoologists.

Major S. S. FLOWER stated that time and patience were required before a useful list of *nomina conservanda* could be compiled.

Systematic zoologists were doing their best and decided progress was being made in many groups of animals.

The system of taking the names that have been used by the greatest number of authors has been tried and found wanting.

The method of priority gives promise of ultimate agreement.

For zoological teaching the students might be divided :—

1st, those who are to become systematic zoologists, who will work up their own groups and not hamper themselves with general text-books.

2nd, those who only use zoology as a subject for passing an examination or for taking a degree.

It appeared then that it was more important in schools and colleges to have an established list of *English names* than of one in Latin or Latinized-Greek.

Mr. J. R. NORMAN expressed the hope that time for further discussion of the subject would be given at some future meeting of the Society.

A botanist in Bermuda. By Dr. A. B. Rendle.

THE Bermudas are an extremely isolated group of islands, separated by deep abysses of the Atlantic Ocean from the nearest land. They lie 570 miles east of Cape Hatteras in North America and 700 miles north-east of the Bahamas. They consist of a cap of æolian limestone surmounting the remains of a remarkably steep volcanic mass. A narrow, somewhat crescent-shaped chain of islands, about 19 square miles in extent is surrounded by a reef in the form of an ellipse within which on the north are extensive shoals and rocks, the remains of a former much larger land area in Pliocene times of about 230 miles in extent which became later submerged. The islands consist of low rounded hills, and have a rocky coast broken especially on the south, where the reef hugs the shore, by numerous sandy beaches and stretches of low dunes. They were dreaded by mariners owing to the dangerous reefs and prevalent gales, and were uninhabited when discovered early in the 16th century by the Spaniards, but no settlement was made until 1612, since when they have been under British rule. The Gulf Stream, which flows to the north-west of the islands, promotes a mild warm-temperate climate, frost is practically unknown, and

vegetation is continuous. The rainfall of 57 inches is distributed throughout the year—July, August, and September are the wettest months.

The native flora has been derived mainly from Florida and the West Indies from fruit or seed carried by ocean-currents, winds, or birds; it includes an endemic element of about 8 per cent. An endemic Juniper (*J. bermudiana*) clothes the hills and valleys, except where land has been cleared for cultivation or building; and an endemic palm (*Sabal Blackburnianum*) flourishes especially in the few marshes which are still undrained. Introduced plants greatly outnumber the native species and have to some extent displaced them. These include many European weeds and other Old World species, besides introductions from America and the West Indies. In the absence of records it is often difficult or impossible to determine whether an individual species is native or has been introduced. The sandy and rocky shore-lines and the few remaining marshes are the most favourable localities for studying the original flora. The marine flora is rich and varied, the broken rocky coast and reefs affording ideal situations.

Mr. W. S. ROWNTREE and Mr. F. OWEN WHITAKER asked questions.

Mr. H. N. RIDLEY referred to the fact that Bermuda was a true oceanic island never connected with the mainland; hence the special interest of the flora. The presence of *Peperomia*, a genus characteristic of oceanic islands, was of interest, the minute fruits being transplanted by adhesion to birds. He also urged that the rock of which the islets were formed was not an æolian sand-drift, but closely resembled the raised altered coral reef of Christmas Island.

In reply to Mr. Ridley, Dr. RENDLE said that there was no doubt but that the islands consisted of wind-blown sand, mainly shell, with remains of calcareous algae, coral, and other organisms. The low rounded hills were eminently suggestive of this origin. A good descriptive flora of the islands had been published by Dr. N. L. Britton of New York.

In reply to Mr. F. O. Whitaker, he stated that records showed that some of our common British plants were among the earliest introductions.

The following paper was read in title :—

‘Reports of an Expedition to Brazil and Paraguay in 1926–7, supported by the Trustees of the Percy Sladen Memorial Fund and the Executive Committee of the Carnegie Trust for Scotland. Copepoda.’ By A. G. LOWNDES, M.A., F.L.S.

26 APRIL 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous Meeting held on Thursday, 12 April 1934, having been circulated, were taken as read and confirmed.

The President announced that the Council had unanimously nominated Dr. W. T. CALMAN, F.R.S., as President of the Society for 1934-35, the ballot for his election to take place at the Anniversary Meeting.

The President stated that Mr. Ronald Good of University College, Hull, who is working on the Lizard Orchis (*Himantoglossum*), would like to have authentic records of its occurrence (not for publication) and data relating to the biology of the plant.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

A certificate of recommendation of the following candidate for Fellowship was read :—For the second time, in favour of Patrick Martin Hall.

Certificates of recommendation of the following candidates for Foreign Membership were read for the second time :—Camille Sauvageau and Otto Rosenberg.

A physiological Tulip Disease.
By Dr. Ina E. Uyldert (Visitor).

TOPPLING OVER is a physiological tulip disease, which occurs in certain varieties of tulips when forced quickly in hothouses. It occurs from January till April, and only extremely seldom in tulips grown in the field.

The most striking symptom of the disease is the toppling over of the peduncle.

In a plant affected with this disease the peduncle in the middle region has at first an appearance as though injected ; glucose as well as sucrose are found to have accumulated in the peduncle, and there is quite an abnormal amount of starch also. At a certain spot, mostly halfway down the peduncle, sugar in solution is often excreted and hangs there as little drops. Some days after at this spot the cells shrivel and the toppling over occurs (cf. M. Pinkof).

In order to know more about this disease, the following experiments were made. I cut off the peduncles with flower-buds and put them in solutions of sugar and nutrient salts, and made a control series that had only sugar. I had to put them in solutions of sugar, otherwise the buds would not open. The sugar solution contained 5 per cent glucose, sometimes 4 per cent sucrose was given in addition. The buds opened after some days and the flowers were normal in both solutions, the peduncles of the series with sugar and no salts became diseased in the same way as the others, that were left on their bulbs. However, the tulips in the sugar solution with nutrient salts remained healthy, especially when calcium salts were added.

Calcium salts have a good effect, for when only calcium nitrate or calcium sulphate were added to the sugar solution, they had the same good effect as a complete nutrient solution. But when a nutrient solution without Ca ions was added, the solution had no effect and the tulips toppled over.

Tulips were also grown in water- and sand-cultures, fifty various nutrient mediae being made up. In those pots that were receiving no calcium, the disease always appeared first and was more serious. Where the normal amount of calcium was added, the peduncle did not topple over or did so later, after the flowers had withered.

For growing tulips in sand-cultures calcium given in the form of calcium sulphate did not work, nor did calcium phosphate; the nutrient media with calcium in the form of calcium nitrate were the best, probably because of the greater solubility of this salt.

This research was carried on under the supervision of Prof. Dr. E. van Slogteren at the Institute for Bulb Research at Lisse, Holland, in 1930-32.

Dr. E. M. DELF made some comments on the paper.

Mr. H. N. RIDLEY mentioned that in some tulips grown in the hot and wet climate of Singapore no peduncle was produced but only a pair of flaccid leaves nearly a foot long and three or four inches wide which lay flat on the ground.

In reply to a question by the PRESIDENT, Miss Uyldert said that sometimes a leaf also has a spot that appears as though injected and the cells shrivel, but then the peduncle shows the same symptoms just where the leaf is inserted.

On some Marsh Orchids. By Mr. H. W. Pugsley.

ALTHOUGH much has recently been written on these plants in Britain, a certain degree of confusion exists respecting the identity of *Orchis latifolia* L., which on the Continent is uniformly regarded as conspecific with *O. majalis* Rehb.

One Marsh Orchid only was known to the early writers from Dodoens onwards, and this was a plant with unspotted leaves which can be shown to be the *O. incarnata* of modern works. This plant constitutes the real basis of Linnaeus's *O. latifolia* described in 'Species Plantarum', and all the material personally known to him, including the specimen in his herbarium, belongs to this form, which must therefore be held to be typical *O. latifolia*. There is no evidence that Linnaeus ever saw a Marsh Orchid with spotted foliage. *O. incarnata* was subsequently described by Linnaeus, together with *O. sambucina*, in the second edition of 'Flora Suecica', where it was contrasted with *O. latifolia*. Its description, however, and the synonym cited refer to *O. sambucina*, as was remarked by Haller, and Linnaeus in 'Species Plantarum', ed. 2, withdrew the allusion to *O. latifolia*, and finally in his second Mantissa acknowledged that *O. incarnata* belonged to *O. sambucina*.

The name *O. latifolia* L. was uniformly applied throughout Europe to the plant now known as *O. incarnata* L. (which in its turn was treated as a form of *O. sambucina* L.) until E. M. Fries questioned this nomenclature, and in 1842 proposed to substitute *O. incarnata* for *O. latifolia* and to transfer *O. latifolia* to *O. majalis* Rehb. This unfortunate change was supported by the younger Reichenbach, and since his time has been used without question, except in Britain, where *O. praetermissa* Dr. has frequently been held to be *O. latifolia* L.

The paper concludes with a synopsis of the British and a few Continental forms, of which an extract is appended :—

I. LATIFOLIAE.

I a. *Latifoliae verae*.

1. *O. latifolia* L. Sp. Pl. (*O. incarnata* auct. recent., non L.).
 - β. *Gemmana*, var. nov.—Planta elatior; spica bracteis longissimis multiflora. Widely spread over Europe.
 - γ. *ochroleuca* (Boll.).
 - δ. *pulchella* (Dr.).
 - ε. *coccinea*, var. nov.—Planta satis nana, floribus coccineis. South Wales.
 - ζ. *cambrica*, var. nov.—Planta satis nana, floribus purpureis breviter calcaratis. Mid Wales.
2. *O. cruenta* Müll.—Discovered in the High Alps above Zermatt in 1933.

I b. *Subsesquipedales*.

3. *O. praetermissa* Dr.
4. *O. pardalina*, sp. nov. (*O. latifolia* Butcher & Strudwick, Further Illustr. no. 350, non L.). Planta elatior, foliis

longe lanceolatis anulato-maculatis. Spica densa, multiflora, floris pallide purpurei labello late rhomboideo duobus amentis purpureis notato. South England, and probably Holland and northern France.

I c. *Majales*.

5. *O. purpurella* Steph.

β. *pulchella* (Dr.).

6. *O. majalis* Rehb.

β. *pinguis* (Asch & Graebn.).

γ. *occidentalis*, var. nov.—Planta satis nana, foliis latiusculis patentibus brunneo-maculatis. Spica brevis, densiflora, floribus saturate purpureis labello trilobato praeditis. Discovered in Co. Clare, Ireland, in May 1933.

7. *O. alpestris*, sp. nov. (*O. latifolius* race *impudicus* Asch. & Graebn.). Planta mediocris, foliis supra medium latissimis valde brunneo-maculatis. Spica laxiuscula, floribus magnis speciosis rubente-purpureis labello lato breviter trilobato variegato praeditis. Widely spread in the Alps.

II. SAMBUCINAE.

8. *O. sambucina* L.

β. *incarnata* Lamk. (*O. incarnata* L. Fl. Suec. ed. 2).

Mr. A. J. WILMOTT made some comments on the paper.

Dr. W. T. CALMAN reopened the discussion on 'Nomina conservanda in zoological teaching'. He said 'Mr. Hewer's list of generic names of animals commonly referred to in zoological teaching is now being examined by the specialists of the Zoological Department of the British Museum (Nat. Hist.) with a view to ascertaining how it compares with the practice of present-day systematists. As far as this examination has been completed, it shows that about three-quarters of the names are open to no objection even on the most rigid interpretation of the rules of nomenclature. Of the changes which have been made by systematists in the remaining quarter of the names, a considerable number express definite advances in zoological knowledge which are obscured by the names most commonly used in current text-books. In these cases the unfamiliar names fulfil a particular function and no one will urge that they should be set aside in favour of names that have no claim but that of common usage, while they may convey implications that are now known to be misleading.

'Only a small number of the changes adopted by systematists can be attributed to a strict reading of the rules of nomenclature or, as Mr. Hewer has pointed out, to the rediscovery of obscure and deservedly forgotten pamphlets of no scientific value. Even in these cases, however, the advocacy of *nomina conservanda* must be qualified by due care to avoid injury in other directions. Where an unfamiliar name has already been adopted in comprehensive monographs which must be in the hands of every specialist for a long time to come, it may prove advisable to adopt them as the lesser of two evils, if the general zoologist is not to ignore, and to be ignored by, the systematist, to the injury of both.

'There is one category of changes, however, on which the advocates of *nomina conservanda* might do well to concentrate in the first instance. Many years ago* I pointed out, as others had previously done, that while a new name for a well-known species might be an inconvenience, the employment of an old name in a new sense was a positive danger. It would be best if such changes could be nipped in the bud before the damage has been done; but where the transference has been accepted in some monograph of authority I should prefer to scrap the name on the ground of ambiguity, replacing it by a new name which would be unfamiliar but would not perpetuate confusion.'

Mr. M. A. C. HINTON said that Dr. Calman had given a true picture of the position. Most of the names in the list submitted by Professor Goodrich and Mr. Hewer were quite right. In some cases the teachers were definitely behind the times; some new generic names were introduced to express the discovery of structural differences of importance, e.g. *Oryctolagus* for the Rabbit to distinguish that animal from *Lepus* the Hares. On the other hand, many systematists forgot that the object of genera was to bring species together and not to separate them; there was no necessity to impose a special generic name for every species that could be readily distinguished from its allies, and there was no doubt that far too many genera were recognized to-day. Genera and species should be broad things, patent to all reasonably competent zoologists; the specialists in each group could have as many subgenera and subspecies as they pleased.

Transfer of names was a crime, and should be avoided at all costs. When it was discovered that the name '*Lepus timidus* Linn.' was based on the Varying and not on the Common Hare, for which it had been generally used for more than a century, the common-sense course was to suppress the name '*timidus*' and not to transfer it to another equally familiar species;

* 'Nature', 26 Jan. 1911, p. 406, and 'Science', 10 Feb. 1911, p. 219.

'*L. europaeus* Pall.' and '*L. variabilis* Pall.' were names free from ambiguity; but to-day when one found '*L. timidus* Linn.' in a book it was necessary to consult a calendar and to make enquiries as to the history and opinions of the author. Even then, particularly in palaeontological writings, one could not be sure of the meaning.

Dr. STANLEY KEMP said it was gratifying to learn from Dr. Calman that only some 25 per cent of the names in this list would need to be changed even on the most rigid interpretation of the laws of nomenclature. But no one with experience of the subject could believe that the remaining 75 per cent were not in danger, and he thought it a matter of urgency that these names should be placed upon a list of *nomina conservanda*. He hoped that Mr. Hewer's list, emended by the specialists at the British Museum, but still, wherever possible, retaining the names used by the founders of zoological science, would in due course be submitted to the International Council.

Mr. I. H. BURKILL, after referring to the measure in which recent name-changes in the Mollusca cause one who is not a constant student of these animals to lose his way in the group, reminded the meeting that the Botanists also have the problem of conservation of names: and he suggested that the measure of their success in establishing *nomina conservanda* by consent might be worth the consideration of the Zoologists.

Mr. J. R. NORMAN said that he did not think it necessary to place on the proposed list of *nomina conservanda* those names concerning which there appears to be complete agreement between the systematic worker and the teacher. He thought that the chances of obscure works containing new generic names being unearthed to-day were very remote, and stated that, although Sherborn had drawn up his list of literature for his '*Index Animalium*' (1758-1850) more than forty years ago, only about five further works had come to light since. On the whole, he was of the opinion that the systematist should be left to himself to find his own way towards a final stability, but that, where names have been transferred from one animal to another, the interests of both parties would best be served by the dropping of these names altogether.

He also pointed out that, whereas in the case of the elementary student of zoology the use of vernacular names would probably be satisfactory, the changes in nomenclature of well-known animals during the past fifty years or more provided a real handicap to the research worker who desired to look up the literature of his subject in such a work as the '*Zoological Record*'.

Dr. G. P. BIDDER urged the importance of making it clear,

with regard to established names, that we object to disturbance elaborated by researches of a bibliophile and not to disturbance necessitated by researches of an anatomist. We all crave for stability, but not to the hindrance of accurate knowledge. Would it not be harmless, and give what we all want, if names which have been in general acceptance throughout thirty or forty years were thereafter immune from disturbance on antiquarian grounds?

There is an easily recognised sponge which was called *Tethya* by naturalists of the 17th and 18th centuries, by Lamarck, Gray, Fleming, and (with the exception of four papers) in all the subsequent scientific writings, monographs, and textbooks of the 19th century. In 1903 Thiele suggested that *Donatia* Nardo is its proper title, and the sponge has since borne that name in important monographs and textbooks, though Vosmaer's posthumous Monograph (1932) and Topsent's authoritative publications still use *Tethya* Lamarck, and no man knows what the upshot will be*.

It is difficult to feel confidence in Mr. Norman's assurance that of literature subsequent to 1758 we have now made all possible discoveries. In the libraries of the British Museum, Royal Society, Linnean Society, Zoological Society, and the University of Cambridge there exists no copy of the Heidelberg 1769 German translation of Ruysch's edition of Jonston's 'Historia Naturalis', nor of the Rouen (1768) French translation, both appearing in Agassiz's Bibliography. Should either have been edited in binomial form we might expect it, in the hands of a diligent student, to be found widely subversive.

English law as to land recognises an absolute title from undisturbed possession over a term of years, and as to debt enforces a statute of limitations. The laws of nomenclature might advantageously imitate one or both of these provisions.

Dr. I. GORDON pointed out that the genera *Astacus* and *Homarus*, mentioned by several previous speakers, had now been placed on the official list of genera, so that it was quite correct to refer to the crayfish as *Astacus*, the lobster as *Homarus* (Smith. Misc. Coll. 73, 5, pp. 25-27, Opinion 104, 1928).

Mr. H. R. HEWER: The reception of the proposals of the Committee of British Zoologists appears to be more favourable than I had hoped for.

Dr. Calman's remarks formed the most useful basis on which to proceed. About the majority of names there would be, it seemed, no dispute. Other instances, indicating well-established advance in systematics when a change of name unfortunately occurred, might well be accepted by zoological teachers and used for instruction on genotypes and other terms in systematics.

* Cf. p. 103.

I further welcome the denunciation of transference as a crime and the description of many changes of name as mere antiquarian sentiment.

Mr. J. RAMSBOTTOM said that Botanists had so many troubles of their own in matters of nomenclature that they had no wish to widen their field. However, as *nomina conservanda* had been mentioned, it might be helpful to state what these were from the botanist's point of view.

The International Rules of Botanical Nomenclature contain a list of *generic* names which, though they are not the names which should be adopted if the Rules are strictly applied, are made valid for various reasons. The list has not been compiled in the manner suggested by several speakers in the present discussion, but by systematists to prevent undue name-changing or unnecessary confusion. There is possibly one exception; presumably the conservation of the name *Welwitschia* as against *Tumboa* was a concession to botanical teachers.

Systematic botanists were so convinced of the necessity for the stability of generic names that they had decided to have lists of *nomina ambigua*, *nomina dubia*, and *nomina confusa*.

Everyone with any desire to see the advancement of biological science must be strongly opposed to wanton name-changing, but it would be surprising if academic biologists should fail to see that some name-changes are necessary to indicate the advance of knowledge frequently due to the researches in their own laboratories.

Prof. W. GARSTANG also contributed to the discussion.

Dr. CALMAN, in replying, called attention to the persistence, in some quarters, of a fundamental misapprehension, expressed in a sentence he had recently met with—'The object of the law of priority is to secure justice for the older writers'. No discussion of the subject was possible unless it was recognized that the rule of priority was merely an arbitrary and often unsuccessful device for securing uniformity of nomenclature.

The following paper was read in title :—

'Results of the Cambridge Expedition to British Guiana, 1933. The fresh waters of the rain-forest areas of British Guiana.' By G. S. CARTER, M.A., Ph.D., F.L.S.

10 MAY 1934

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the General Meeting held on Thursday, 26 April 1934, having been circulated, were taken as read and confirmed.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellow signed the Obligation in the Book of the Charter and Bye-Laws and was admitted :—Robert Bernard Benson.

A certificate of recommendation of the following candidate for Fellowship was read :—For the first time, in favour of Ram Surat Singh.

The following candidates were balloted for and elected Fellows :—Paul Westmacott Richards, M.A., Ernest James William Barrington, B.A., B.Sc., Theodore Edward James, Gordon Wright, Dorothy Bexon, M.Sc., and Patrick Martin Hall.

The following candidates were balloted for and elected Foreign Members :—Professor Camille Sauvageau and Professor Otto Rosenberg.

The President reported the death of Professor Robert Chodat, F.M.L.S., and moved the following Resolution, which was passed in silence, all standing :—

The Fellows of the Society have heard with great regret of the death of Professor ROBERT CHODAT who has been a Foreign Member of the Society since 1914 and was awarded the Linnean Medal last year. This Meeting of the Society desires to put on record its high appreciation of the eminent services Professor Chodat has rendered to botanical science and wishes to extend to his family its sincere sympathy in their bereavement.

The generic name *Tethya*. An example of the operation of the Laws of Nomenclature. By G. P. Bidder, Sc.D.

FOR 300 years or more a sponge, 2 to 3 cm in diameter, looking like an orange-coloured plane-fruit but almost stone hard, has been well known to naturalists. Jonston (1650) represented it in the first and second figures of his '*Variae Species Thetijorum*'; Donati (1750) with an admirable plate described it as a '*Tetie*'. Lamarck (1815), under the name of *Tethya lyncurium* Linn., made it precede *Tethya cranium* Müll. in a genus *Tethya* defined formally, but vaguely, and headed by four unrecognisable new species.

Subsequent inconvenience has arisen from the facts that the type of Lamarck's fourth species, *Tethya lacunata*, was re-described by Schweigger (1819) with a new definition of the

genus and a figure which proves *T. lacunata* to have been a Geodid (*Geodia* Lam., defined by the untypical hollowness of the type, follows *Tethya* Lam. in 1819 as 1815). Topsent (1920) examined Lamarck's types of the second species, found to be a Tetillid, *Cinachyra providentiae* Dendy, and of the third species, determined as *Stelletta pulvinata* Lamarck. Topsent's research leaves the first species, *T. asbestella*, still unidentified: according to Dendy (1916) Lamarck's description shows that it is not congeneric with *T. lyncurium* Linn.

Vosmaer (Bronn, p. 42) considers that Schweigger's figure represents a true *Geodia*, Topsent (1930, p. 8), that we can say it is one of the Geodidae. I do not remember that anyone has proposed Schweigger's redefinition, with this uncertain type, as binding on us. Therefore the way was open for the redefinition by J. E. Gray in his father's 'British Plants' (1821), with a very clear description of his type-species *Tethya verrucosa* Montagu, which he considers a synonym at once of *Alcyonium Lyncurium* Linn., *Alcyonium Aurantium* Pall. (the precedent name, as pointed out by Gray 1867, Topsent and Vosmaer), and *T. lyncurium* Lam. This would seem to have settled *T. aurantium* as the type-species of Lamarck's genus *Tethya*, but that view was not taken by anyone, even by J. E. Gray himself 46 years later. In 1867 he revived Nardo's still-born genus *Donatia* (1833) for *D. aurantium* and defined *Tethya* Lam. with type-species *T. cranium*, quoting Johnston (1847). Nevertheless, the great monographs and text-books of the 19th century called our sponge *T. lyncurium* Linn., Sollas relying on O. Schmidt's (1862) re-definition*.

In 1903, in a footnote to his account of *T. lyncurium*, Thiele stated didactically that by the Rules of Nomenclature the generic name *Tethya* really belongs to the Tetillid genus *Craniella* (= *T. cranium* Lam.). Thereafter Baer (1905), Hentschel (1909) and Dendy (1916) used Nardo's name *Donatia* in such large and important publications that others conformed to the change—myself unbelieving (1925), but valuing uniformity. Lately, however, books as important, which consistently use the name *Tethya aurantium*, have been published by Topsent and posthumously by Vosmaer (1932).

These differing opinions have been held by zoologists of the highest ability and great learning, conscientiously endeavouring to apply the current laws of nomenclature. It is fortunately

* The neglect of Gray (1821) may be partially explained by a passage in Dendy and Row (1913), p. 793, concerning a Calcareous genus founded by J. E. Gray in the same 1821 book:—'*Scypha* has actually priority over Risso's *Sycon*, but the latter has so long been in general use that it seems desirable to retain it. Moreover, the earlier name was proposed by a botanist for organisms which he regarded as plants.' The latter illogical argument may have influenced others (including J. E. Gray himself) who were aware of Gray's definition of *Tethya*.

not necessary to discuss here how far their unanimity was justified in regarding publication by a botanist as negligible, nor whether they had option of selection between the successive definitions of Schweigger, Fleming, Johnston, Bowerbank, and O. Schmidt. It is unnecessary because all the opinions of these well-read experts were based on the premiss that the genus *Tethya* was created by Lamarck in 1815. I submit, on the contrary, that it was created by Ellis and Solander in 1786, with type-species *Tethya sphaerica* Ellis & Solander=*T. aurantium* Pallas.

The passage in Ellis and Solander, p. 174, was originally written by Ellis, as shown by 'I think', 'I mean', 'I believe', &c., six times in 250 words; but without knowing the date of this part of his MS. we cannot guess whether he or Solander placed it in its strictly Linnean form, therefore modern union of their names is correct. It was only the discussion at the Linnean Society on April 26th which made me realise the significance of this passage according to modern usage; the reason for its escaping the notice of other spongologists is obviously because it occurs in the section on Corals, under the description of *Alcyonium*, genus XV of the Madrepora. Ellis ignores with kindly silence Donati's bold views as to the locomotion of 'Tetie', and brings into a realistic biological scheme the mystical 'Animali-plante'.—

'Others that are ranged among the *Alcyoniums* approach more to the genus of Sponges, particularly to those that are composed of small spiculae, which are intimately blended with their gelatinous flesh. . . . Donati, who had the opportunity of examining most of these bodies alive, never discovered any polypes on the surface of either the *Alcyonium Lyncurium* Linn. or *Tethya Sphaerica* Donat. Adriat. tab. 10 or the *Alcyonium Cydonium* Linn. or *Alcyonium prim.* of Donat. Adriat. tab. 9. The *Ficus* of Marsigli, which has been introduced as an *Alcyonium*, is evidently a sponge.'

If Ellis and Solander had merely quoted '*Tethya sphaerica*' from Donati it would be use of the name in a strictly Linnean work of 1786. But (*pace* Topsent, 1930, p. 4) Donati never used either this generic or this specific name, and 'name' hardly designates his many-worded Italian description. On page lxiv he heads his account of the organism with this sentence:—

'*Tetie sferica, con superficie da tubercoli semisferici formata, e con vertebra nel centro.*'

Similarly, he does not write '*Alcyonium prim.*' but '*Alcionio primo di Dioscoride*' (= *Geodia*, fide Vosmaer, Bronn, p. 25).

Unlike Johnston (1842, p. 85) Ellis and Solander have deliberately refrained from quoting Donati's Italian description. They have translated its first two words into Latin

and formed of them a binomial name conforming with Linnean rules. This was natural in Ellis, a correspondent of Linnaeus, and still more so in his editor Solander—protégé of Linnaeus and a Keeper of the British Museum. Unconscious that Pallas had already called it *Alcyonium aurantium*, they found a well-defined and well-known organism without a Linnean name, and, when it became necessary to refer to the organism, they did the obvious duty of Linnean naturalists in supplying a Latin binomial name. The definition: 'Tethya Sphaerica Donat. Adriat. tab. 10' is complete: no one has ever doubted that Donati's copperplate represents our species, which is therefore the type-species of the genus *Tethya* Ellis & Solander 1786, *ex* Donati, 1750.

Ellis and Solander's name *Tethya sphaerica* was used by Fleming (1828).—

In regard to 'Zoophyta', Fleming considered Ellis the leader in observation and thought, quoting one or other of his works in every third paragraph. On p. 515 he quotes Ellis and Solander's p. 175, facing '*Tethya Sphaerica* Donat.' of their p. 174. Then on p. 520 he writes for his second species:—

'*T. sphaerica*.—Surface thickly covered with tubercles, destitute of hairs, Donati Mer Adriat. 62, t. x. f. 1'*

As the modern laws of nomenclature did not exist, he did not attribute the name to Ellis and Solander, but followed their attribution to Donati, though knowing that in the

* Numerical references to Donati are subject to an inconvenient confusion between the French translation (La Haye, 1758) and the original Italian work (Venezia, 1750). The translation was used by Ellis and Solander (1786), by Fleming, and by McAndrew, whose copy is in the Philosophical Library at Cambridge. The original was used by Ellis (1766), by Johnston (1842, p. 85), by Hogg (1839 *α*. p. 401), and by Linnaeus, since his copy is preserved by the Linnean Society. Donati has no plate x: '*Tetie sferica, con superficie*', &c. is described on p. lxiv, referring to 'Tavola ix (Fig. A.B.c)'. Tav. ix is the last numbered plate; the following plate is not numbered because it has no connexion with the others and illustrates a paper by a different author on a flowering Alpine plant (*Vitalia*, nov.).

The publisher of the translation has added a new 'Planche i' (purporting to illustrate Donati's fishing apparatus), and thereby has added one to the number on each of Donati's plates; he has also added numerals to the letters by which Donati distinguished the separate figures on each plate. On the title-page, 'dell' Adriatico' becomes 'de la Mer Adriatique' as in Fleming's abridged title; p. lxiv becomes p. 62; and Tavola ix is lettered 'x pl.', while Fig. A has a '1' added. Ellis (1766) correctly states that the commensal worm in *Alcyonium primum* Dioscoridis is described and figured:—'Donat. Hist. M. Adriat. p. 58, t. 8, fig. G.' In 1786 the host is described as '*Alcyonium prim.* of Donat. Adriat. tab. 9', suggesting that Solander altered the correct reference to agree with the numbering of the plate in an accessible copy of the French translation.

The French version was rightly treated as important, because it professes to have been corrected by Donati, and on the back of the title-page is a late correction which distinctly modifies a statement in the Italian text; there are also some useful and scholarly notes. In the Cambridge University Library the original and the French version are bound together in an eighteenth century binding.

French version of Donati which he used the sponge was '*Tethie spherique*' &c., a French description with no Latin word*.

It will be noticed that Ellis only says of *Tethya sphaerica*, *Alcyonium Cydonium*, and *Alcyonium prim.* that they 'approach more to the genus of sponges', whereas 'The Ficus of Marsigli is evidently a sponge'. After the definition and description of the genus *Spongia* (p. 182) he writes:—'But I must observe here that those that are composed of the stronger and larger bundles of elastic fibres, like needles, though they have been reckoned Alcyoniums by most authors, yet in my opinion it appears . . . ' [because Marsigli and Donati] 'could never discover any polype suckers extending out of their pores, that they should not be reckoned among the Alcyoniums; for these polype suckers are the distinguishing character of that genus, as much as the pores without the polypes in these elastic fibrous bodies is the character of the Sponges. These are the *Alcyonium Lyncurium* and *Alcyonium Cydonium* of Linn. Syst. pag. 1295.' Montagu (1812, p. 69) summarises the position left by Ellis:—'*Lyncurium* and *Cydonium* approach very near to *Spongia*; but these, with two or three others of similar structure, might perhaps be formed into a new genus, if any advantage to science could be gained by it.' He then groups together as 'Orbicular species' (p. 117) *Spongia verrucosa* and *Spongia pilosa*, being the *Tethya lyncurium* and *T. cranium* of Lamarck, Fleming, and Johnston.

Ellis would therefore have been ready, like Lamarck and Fleming, to regard Geodidae and Tetillidae as congeneric with *Tethya Sphaerica* (= *T. aurantium*), and Lamarck seems to have endeavoured to carry out his views, adding also *Stelletta*. The genus *Spongia*, as used by Ellis, included horny, siliceous and calcareous sponges; if alongside *Spongia* a second allied genus were added under the name of *Tethya*, corresponding nearly to the suborder Choristida of Sollas (1887), science would be considerably advanced.

Fortunately Ellis and Solander printed the new generic name *Tethya* connected with only one species, of unquestioned identity; and the words written by Lamarck and the types which he used are alike powerless to disturb the right of the sponge described and figured by Donati to the name created for it by Ellis and Solander.

I trust that *Tethya* Ellis & Solander, with type-species *Tethya aurantium* Pallas, may be indexed as a *nomen conservandum*. I hope that some course of action will be taken

* Fleming in 1822 (ii, 614) defined the genus *Tethya* inconclusively, without type; he now makes *T. cranium* his first species. Johnston (1842) followed him; Bowerbank (1864 and, less definitely, 1862, p. 1106) followed Lamarck in placing *T. lyncurium* before *T. cranium*.

to prevent any note like Thiele's or any paper like this ever being published again. Bronn's Thierreich, the *Challenger* Monographs of Ridley & Dendy and of Sollas, the textbooks of Yves Delage, Minchin, and J. Sollas should have formed a barrier of authority for nomenclature behind which pious exhumation would be inoffensive. Zoology will not be advanced in the least if Lamarck's first species of '*Tethya*' be identified, nor is it advanced by knowing that in 1786 Ellis and Solander defined *Tethya sphaerica*. It is time that we cease to divert from research the energies of able men like Thiele and Dendy to pursue futile arguments of the schoolmen and useless archaeological enquiries, which are necessarily fallible and necessarily imperfect.

LIST OF REFERENCES.

Up to 1913 references will be found under the appropriate year in Vosmaer's 'Bibliography of Sponges', Cambridge, 1926 (to which, however, add :

1839. HOGG, JOHN. Observations on the *Spongilla fluviatilis*. Trans. Linn. Soc. xviii, pp. 363-367.
 1839 a. HOGG, JOHN. Further observations on the *Spongilla fluviatilis*; with some remarks on the nature of the Spongiae Marinae. Trans. Linn. Soc. xviii, pp. 368-407.)
 1916. DENDY, ARTHUR. Report on the Homosclerophora and Astrotetrazonida collected by H.M.S. *Sealark* in the Indian Ocean. Trans. Linn. Soc. vol. xvii.
 1920. TOPSENT, E. *Tethya aurantium* (Pallas) et les *Tethya* de Lamarck. Bull. Mus. Hist. Nat. pp. 640-646.
 1925. BIDDER, G. P. 'Nature', vol. cxv, p. 299.
 1930. TOPSENT, E. Éponges de Lamarck conservées au Muséum de Paris. Archives du Muséum d'Histoire Naturelle, Paris. [Extrait.]
 1932. VOSMAER, G. C. J. The Sponges of the Bay of Naples. Porifera Incalcaria. (Edited by C. S. Vosmaer-Röell and M. Burton, M.Sc.)—Part III. The Hague.

Nuclear migrations in *Hedychium*.

By Dr. Margaret Madge (Visitor).

IN the ovules of *Hedychium Gardnerianum* there is a characteristic cup of thick-walled tissue in the nucellus at the base of the embryo sac. After pollination the nuclei in the nucellus below this region begin to migrate from cell to cell until they reach these thick-walled cells. Here their passage is stopped, and groups of twenty or thirty nuclei collect together, surrounded by ragged cell walls which have been broken down as a result of their passage. Some of the nuclei migrate around the thick-walled cup into the embryo sac itself, where they may serve some nutritional purpose. Later they degenerate.

In their migration the majority of the nuclei pass from cell to cell through a small hole in the cell wall. Individual nuclei are, however, found which have begun to pass through the cell wall in more than one place at once. Their appearance

suggests an unsuccessful attempt at migration and resembles the chromatin extrusion found in pollen mother cells to which Prof. Gates has given the name cytomixis.

Professor R. R. GATES remarked that the interesting observations of Dr. Madge were, in one aspect, an extension of observations made by him on *Oenothera* many years ago. He had shown that in one stage of synapsis in the pollen mother cells the nucleus became excentrically placed. If it touched the cell wall at a point where there happened to be an opening, then chromatic material flowed through into the next cell, often producing there a pseudo-nucleus. This process he called cytomixis and it had since been described in the pollen mother cells of many other plants. There had been much discussion as to whether, or in what sense, the process was normal. The conditions observed by Dr. Madge in *Hedychium* were evidently in part cytomixis, but in other cases, where the nucleus passed entire into a second or third cell, the process was one of nuclear migration similar to some of the movements of nuclei observed by Farmer and Digby in fern prothallia. The frequency of the occurrence of this condition in *Hedychium* led him to regard it as probably normal.

Preliminary note on Pollination in *Centaureum*.

By Mr. J. S. L. Gilmour.

FROM a consideration of the pollination mechanisms of the two species *Centaureum umbellatum* and *C. compressum*, it appears probable that the former is very largely self-pollinated, while the latter is frequently cross-pollinated. Experiments undertaken to test the relative amounts of cross- and self-fertilization in the two species confirmed this view. No evidence was found in favour of definite heterostyly in these two species, differences in the relative positions of style and stamens being due to differences in growth of the corolla tube to which the stamens are attached.

An outline of the present distribution of the two species was given, and the chief factors determining it were considered to be climatic and edaphic. It was suggested, however, that the differences in the amount of self- and cross-fertilization between the two species may also have played a part, since in mixed, cross-breeding populations of the two species *C. compressum* would tend to become replaced gradually by *C. umbellatum*. The occurrence to-day on the coasts of central and southern England of what may be considered as populations of hybrids between the two species seems to confirm this view.

Prof. E. J. SALISBURY commented on the paper.

Explorations in Tibet 1933. (Lecture : with lantern slides, including direct colour transparencies.) By Capt. F. Kingdon Ward.

My expedition to Tibet in 1933 was made with the object of throwing further light on the distribution of floras in S.E. Asia, and of ascertaining whether there was any evidence for the extension of the Himalayan uplift east of the Tsangpo gorge. The region selected was the unexplored country between the Tsangpo and Salween rivers ; this seemed to be a key position as regards floras. Hereabouts three of the Asiatic floral regions meet—Central Asian, Eastern Asiatic, and Indo-Malayan.

Hitherto the flora of Tibet has been assigned *en bloc* to the Central Asian region ; though Hooker extended the Eastern Asiatic region in a narrow belt along the southern face of the eastern Himalaya, as far as Nepal. This extension appeared, from later exploration, to be discontinuous, as though cut across by some other flora. Bayley Balfour insisted rather on the differences between the Yunnan and eastern Himalayan floras ; it is the resemblances which I would point out. More and more have Chinese alpine plants been found in the eastern Himalaya, and *vice versa*. A. R. Wallace, on the other hand, stressed the close connection between the eastern Himalaya and Malaya, particularly as regards birds. The apparent topography would support that connection ; and the advance of the ice during the last glacial epoch would go far to account for it. The advance of the ice, however, had a comparatively small effect on the flora as a whole, partly owing to the considerable difference of latitude and partly to other causes. Experience shows that the main Himalayan relationships lie eastwards across China, to Japan and Formosa, not southwards through the Malay Archipelago. The problem is to reconcile this fact with the present physiography of S.E. Asia. In order to do this, it is above all necessary to get a clear idea of the great changes which have taken place here.

Tibet is a great plateau, surrounded by loftier ranges of mountains. In Cretaceous times it was at the bottom of the sea called Tethys. In Eocene-Oligocene times it was uplifted, together with the Himalaya. At that time the mountains of Burma-Yunnan were already old, never having been beneath the sea since Permian times. The Tibetan plateau is divided into three parts :—

- I. The Chang Tang. Drainage internal, lakes salt. Average altitude 16,000 feet. The chief feature of the severe climate is drought. About a hundred species of flowering plants, one-fifth of them grasses. No woody plants.

II. The Outer Plateau. Rivers flow outwards (mostly eastwards) in wide shallow troughs. Average altitude 12,000–14,000 feet. There is considerable drought, but it is less severe than that of the Chang. No forest, but a considerable alpine and shrub flora. Scattered trees.

III. The River Gorge country. The rivers converge and cut deep gorges through the boundary ranges. Heavy precipitation giving rise to dense forests and extensive alpine flora.

It is important to remember that these are all part of the original plateau in different stages of demolition.

In the river gorge region, the rivers are flowing south, having changed their west to east direction. On modern maps, the mountain ranges also are shown as curving round from a west to east alignment to a north-south alignment. The Himalayan range is usually regarded as ending at the Tsangpo, or bending back on itself parallel to the Brahmaputra, and continuing southwards as the Malay Arc—these hill ranges being contemporaneous with the Himalayan uplift. Burrard held the view that the great range between the Tsangpo and the Salween in Tibet turned southwards and became the Salween-Irrawaddy divide. If that was so, the Himalaya must end at the Tsangpo. Burrard, in the light of further exploration, has taken the opposite view, that the Himalaya are continued eastwards, as Kropotkin believed. Kropotkin's theory of Himalayan extension, however, was based on some ideal structure of plateaux and their bounding ranges, and was highly speculative. It was Gregory who, as a result of his journey to Yunnan in 1922, produced the first real evidence of disturbance in the older rocks, due to Himalayan folding.

By ascending the Lohit river, from Sadiya in Assam to its two sources in Zayul, I was able to show that this river rose in a great snow range with an alignment approximately north-west to south-east. Crossing this range, which is about 75 miles wide, I descended to the Salween river, just east of the Tsangpo gorge. Here I found direct evidence of the Himalayan uplift having thrown old strata-limestones, slates, and sandstones into fold mountains from the north.

The flora entirely supported the idea that this range stretched eastwards from the Tsangpo gorge, and was therefore a direct continuation of the Himalaya. To the south was the forest flora of the river gorge country, occupying ice-worn valleys in which the rivers had subsequently cut deep gorges. To the north was the alpine flora of the outer plateau, with no forest, but scattered trees. This alpine flora was very similar to that of north-west Yunnan, and also to that of the plateau east of Lhasa.

The several floras encountered during the march up the Lohit river, from Sadiya in Assam to the snow-range, thence across the range to the Salween valley, may be tabulated as follows :—

- I. Sadiya to the Tibetan frontier. Indo-Malayan jungle, 1,000–3,000 feet. Evergreen. Above 4,000 feet, hill jungle.
- II. Rima, in Zayul, and northwards up the western branch of the Lohit or Zayul river. 4,000–6,000 feet, pine forest (*P. Khasia*). Above 6,000 feet, temperate forest. *Pinus excelsa*, *Tsuga yunnanensis*, *Acer*, *Quercus*, *Ilex*, *Magnolia Campbellii*, *Rhododendron sino-grande*, and many other species.
- III. Zayul, on the south side of the great snow range. 6,000–9,000 feet, temperate forest. *Magnolia globosa*, *Pyrus*, *Prunus*. 9,000–12,000 feet, Conifer-Rhododendron forest, with *Larix tibetica*, *Abies Webbia*, and *Picea Morinda*.
- IV. On the great snow range, above 12,000 feet. Wet alpine flora as on the southern face of the Himalaya. *Nomocharis*, dwarf Rhododendrons.
- V. On the plateau north of the great snow range (Shugden Gumpa), dry alpine flora as in the grazing country of Tibet generally, and on the highest ranges of north-west Yunnan, 13,000–15,000 feet. Gentians and Compositae in great variety: many Ranunculaceae, *Stellera chamaejasme*, *Primula tibetica*, *Oxytropis* and *Astragalus*, numerous shrubs, especially *Lonicera*, but only four species of *Rhododendron*, *Picea lichiangensis*.
- VI. Arid valley of the Salween, 9,000–11,000 feet. Dwarf, often prickly shrubs of suffruticose habit: *Caryopteris*, *Mentha*, *Ceratostigma*, *Aster*; herbaceous plants only where water comes to the surface, and by streams.

Lord ABERCONWAY asked to what Capt. Kingdon Ward attributed the great difference between the flora in the district which he visited to that which he previously had found in the Tsangpo Gorge only some fifty miles further west, especially as regards the numbers of Rhododendrons present.

Mr. I. H. BURKILL spoke of the evidences in the Himalaya of increased glaciation during the Ice Ages and of the possibility that the amount of additional ice was less at the eastern end of the range than at the western, where glaciers came 4,000 feet lower than they are now; but pointed out that as the Equator cannot have been appreciably cooler during the

Ice Ages, very tempestuous weather must have occurred in the belt between the ice fields and the Equator owing to the proximity of the one to the other. Therefore there was water in plenty for cutting the gorges. He mentioned that the genera confined to the Himalaya are small genera of one or at the most a very few species, as if recent evolutions.

Mr. EDMUND BAKER congratulated Captain Kingdon Ward on the very fine collection he had made.

The Leguminosae of the collection have been partly determined. There is a very interesting plant allied to *Caragana* which appears to be quite new, but rather further research is necessary.

Mr. J. RAMSBOTTOM congratulated Capt. Kingdon Ward on his safe return after another hazardous plant collecting trip. It was yet too early to say what were the purely botanical results of the expedition, but there was every likelihood of their being of great value. We were gradually filling in the blanks of our knowledge of the flora of the Himalayas, and in this work Kingdon Ward's name stands foremost on account of his quarter of a century's application to the task.

The lantern slides illustrating the lecture called for some comment. All would agree that it was hardly credible that such excellent photographs could be obtained under the conditions of the journey.

The PRESIDENT said with what interest all had listened to the paper.

The following papers were read in title :—

‘On a collection of South African Polychæta, with a catalogue of the species recorded from South Africa, Angola, Mosambique, and Madagascar.’ By J. H. DAY, B.Sc. (Communicated by Dr. E. J. ALLEN, F.R.S., F.L.S.)

‘Notes on the Linnean type-specimens of Flying-fishes (Exocoetidae).’ By ANTON FR. BRUUN. (Papers from the *Dana* Oceanographical Collections, No. 2.) (Communicated by Dr. STANLEY KEMP, F.R.S., Sec. L.S.)

The President announced that the title of his presidential address to be delivered on 24 May was ‘On the northward extension of the Mediterranean Flora’.

24 MAY 1934

ANNIVERSARY MEETING

Professor F. E. WEISS, F.R.S., President,
in the Chair

The Proceedings of the previous meeting, held on Thursday 10 May 1934, having been circulated, were taken as read and confirmed, after the title of Dr. G. P. Bidder's paper had been corrected to read 'The genus *Tethya* not Lamarek (1815) but Ellis (1786)' [*cf.* p. 103].

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted:—Sydney Renoden Wycherley, Theodore Edward James, Bernard Dearman Burt, and Paul Westmacott Richards.

Certificates of recommendation of the following candidates for Fellowship were read:—For the second time, in favour of Ram Surat Singh; for the first time, in favour of Geoffrey John Kerrich.

The Treasurer presented his Financial Report and the Accounts of the Society, duly audited, for the year 1933–34. On a motion by Sir Arthur W. Hill, K.C.M.G., F.R.S., seconded by Dr. H. Hamshaw Thomas, M.B.E., F.R.S., the Report and Statement of Accounts were adopted.

The Bye-Laws regulating the Election of Council and Officers having been read by the Assistant Secretary, the PRESIDENT declared the Ballot for Council and Officers to be open, and voting began. The Ballot for Council was closed at 5.30 p.m. and for Officers at 6.0 p.m.

Meanwhile the Librarian and Assistant Secretary presented his Report as follows:—

LIST OF THE SOCIETY.—Since the last Anniversary Meeting the Society has lost thirty-nine members. The detailed statement is as follows:—

20 Fellows by death:—Walter Barratt, Edwin Harold Brown, George Russell Bullock-Webster, Lilian J. Clarke, Reginald Cory, William Grant Craib, Louis-Leopold Baynard De Beaumont, Eric Drabble, Francis Gayner, Henry George Greenish, Charles Carmichael

Lacaita, Clive Errol Lord, Malte Oscar Malte, Ashley Henry Maude, Thomas Hayton Mawson, Dukinfield H. Scott, Otto Stapf, Harry Frank Tagg, Hon. George Malcolm Thomson, Sydney Howard Vines.

3 Foreign Members by death :—Erwin Baur, Robert Chodat, Hermann Christ-Socin.

10 Fellows by withdrawal :—Henry Charles Abraham, Helena Bandulska, Herbert William Roy Bertrand, Madeline Carson, Annie Dixon, Mary Dilys Glynne, Marian Gull, Thomas Harvey Johnston, Frank Campbell McClellan, William Arthur Wilkinson.

6 Fellows by removal :—Walter Hoare, Aldewin Cecil Ibbotson, Edward Edgar Pescott, William John Phillipps, Robert Swainson-Hall, William Charles Tippet.

During the Session 2 Foreign Members and 28 Fellows have been elected. Of the 28 Fellows elected, 22 have qualified. Also 1 Fellow has qualified who was elected at the end of last Session.

The present number on the List of Fellows is 737, with 7 Fellows elected, but not yet qualified.

LIBRARY.—Between 1 May 1933 and 30 April 1934 8 books have been purchased and 40 books, 413 parts of periodical publications, and 519 reprints have been presented. During the same period the number of volumes bound was 520 and 111 volumes of pamphlets cased; the number of volumes borrowed by Fellows and Associates was 1367 and by the National Central Library, 317. On the other hand, 23 volumes were borrowed from the Science Library for the use of Fellows. 934 signatures were recorded in the Library Visitors' book, exclusive of 82 for Saturday afternoons.

Dr. R. T. Gunther has given his valuable help in the arrangement of the Society's collection of zoological pamphlets and in other ways, and Mr. A. W. Sheppard his usual help as an unofficial worker in the Library.

LINNEAN COLLECTIONS.—Between 24 May 1933 and the 23 May 1934 the Herbarium has been consulted fifty-two times by visitors, who have examined ninety-one genera; the zoological collections have been consulted seven times. As a result of one of these consultations, Mr. Anton F. Bruun of Copenhagen has written a paper on the Linnean type-specimens of Flying-fishes, which is about to be published in the Society's Journal.

SMITHIAN MSS.—The thanks of the Society are due to Mr. Warren R. Dawson for undertaking, free of cost to the Society, the compilation of a catalogue of the correspondence and other MSS. of Sir James Edward Smith, our first President.

At the conclusion of the Assistant Secretary's report, the PRESIDENT appointed Mr. A. D. Cotton, Mr. H. N. Ridley, C.M.G., F.R.S., and Mr. A. W. Sheppard as Scrutineers of the Ballot.

In handing the Linnean Gold Medal to Sir SIDNEY F. HARMER K.B.E., F.R.S., the PRESIDENT addressed him in the following words :—

Sir SIDNEY HARMER, It gives me great pleasure that one of my last acts as President of this Society is to hand to you, my predecessor in this Office, the Linnean Medal awarded to you by our Society.

Linnaeus, I am sure, would have been delighted with this award. Nothing was nearer to his heart than his beloved museum on the little hill behind his house at Hammarby where he kept his precious collections, now in the safe custody of this Society. You, Sir Sidney, have been a custodian of Museums for many years, first at the University Museum in Cambridge and later in London, where until recently you were the Director of the Natural History Museum at South Kensington. But it is not primarily as a holder of these distinguished offices, useful as their work is to zoological science, that we honour you to-day. The Linnean Medal is awarded to you for the eminent services you have rendered to science as an investigator.

There are probably few zoologists living who were contributors to the Reports of the *Challenger* expedition. But I well remember the enthusiasm with which my great teacher, Sir Ray Lankester, welcomed your demonstration, given in that publication, of the morphology of *Cephalodiscus* and its relationship to *Balanoglossus*. This outstanding discovery you followed up with further investigations into the Hemichordata.

The Polyzoa too have not only attracted your attention, but have proved a field of fruitful researches from the time of your early studies of their embryology. Our knowledge not only of their morphology, but also of their taxonomy, has been greatly enriched by your labours, and we are proud to think that the presidential address to us on this group of interesting animals which you gave in 1929 was in itself an important contribution to the knowledge of the subject.

We desire to express the hope that your monumental treatise on the collections of Polyzoa made by the *Siboga*

Expedition, on the last parts of which you are at work in your retirement, may soon be completed.

Fellows of the Society who are less familiar with zoology will no doubt associate your name more readily with the group of Whales, on which you are an authority of world-wide reputation. This you have deservedly gained, not only by your zoological publications on the Cetacea, but also by the interest you have shown in practical questions affecting whaling and particularly in the preservation of this rapidly diminishing group of animals by pointing out the grave dangers of uncontrolled commercial exploitation. We remember the presidential addresses on whaling you gave to the Society in 1928 and 1930, full of interest for our Fellows, and in addition full of scientific data, so that they will long remain valuable contributions to scientific knowledge. It is pleasant to think that the British Museum has raised a monument to your active interest in the Cetacea in the form of the new Whale Gallery, in which your large pets are more amply provided with space for their display.

You have constituted yourself the protector of the whales. It needs a great man to be the protector of Leviathans. I do not know whether you were born great, but history will record that you achieved greatness, and for the greatness of your achievements we have with unanimity resolved to bestow upon you the Linnean Medal. ↓

In reply, Sir SIDNEY HARMER expressed his profound appreciation of the honour that had been conferred upon him.

In the introductory passage to his Address, the PRESIDENT made the following statements :—

As you have heard from the Assistant Secretary's report we have, alas! this year again lost a large number of our Fellows and several of our Foreign Members by death. We mourn the fact that a cruel fate cut off a few weeks before his hundredth birthday Dr. Hermann Christ-Socin of Bâle, who was still engaged on floristic work in the last year of his long life. Early in the year Dr. Erwin Baur, Director of the Institute for Plant Breeding in Müncheberg, whom we had elected only last year died suddenly and unexpectedly in the midst of his active life, and only a few weeks ago we heard the news of the death of Prof. Robert Chodat of Geneva, to whom we awarded the Linnean Medal last year. Though he was unable to receive the Medal personally, owing to illness, we had reason to hope that he would make a complete recovery. Alas! it was not to be, but we have the satisfaction of knowing that the last year of his life had been considerably brightened by

the recognition we had made of his conspicuous services to botanical science.

It will not, I am sure, be considered invidious if, from the list of the Fellows we have lost by death, I single out for a few words of deep regret the names of two Past Presidents who died early this year.

Professor Sydney Vines, who was President from 1900–1905, will always be remembered with gratitude for his activity in his younger and energetic days in establishing the first laboratory instruction in Botany in Cambridge. With the stimulus derived from teaching under Huxley and Thiselton Dyer at South Kensington, and Sachs at Würzburg, he initiated Cambridge students in laboratory methods of study and research. Botanical students of to-day working in well-equipped laboratories should be reminded of the man to whose perseverance they owe the present-day facilities. Though in his retirement at Exmouth he could not take any active part in our meetings he continued his interest in our proceedings to the last, and it was a great satisfaction to him that the contributions of a number of our Fellows made it possible to purchase for the Society the portrait of his old teacher, Julius Sachs.

It is not necessary for me to remind Fellows of the ever-active interest taken in our Society by the late Dr. Henry Dukinfield Scott. President from 1908–1912, Vice-President on four occasions, and repeatedly a member of the Council, he came up frequently to our meetings from his country home near Basingstoke. His last visit was only a month before his death, when he took as usual an active part in the discussion of communications. Not only the Society, but most Fellows individually, have lost by his death a dear and valued friend.

Except for these heavy losses of distinguished Fellows, I think I may say the past session has been a successful one, thanks to the energy of the Secretaries in providing us with a varied and interesting programme at our fortnightly meetings. To them our thanks are due, and to the various Fellows and Visitors who have made such interesting communications to the Society, or taken part in our discussions.

I now come to the subject of my address, and if you consider that I have chosen a subject on which I cannot speak with any authority, I trust you will excuse my audacity, which has been prompted by the interest I have felt in the subject ever since I was privileged to see the Mediterranean Heath, and other Lusitanian plants in the West of Ireland in the company of Lloyd Praeger, and to gather Mediterranean forms in the hot valleys of Switzerland. If my treatment is inadequate, the subject itself will, I hope, prove of interest

to the Fellows present. And though I shall confine my remarks mainly to plants, the conditions governing their distribution apply equally to animals, so that zoologists may find in my Address some facts worthy of their consideration.

The PRESIDENT then delivered his Address, 'On the northward extension of the Mediterranean Flora'.

On its conclusion, Dr. A. B. RENDLE, F.R.S., moved 'That the President be thanked for his excellent Address, and that he be requested to allow it to be printed and circulated amongst the Fellows'. The motion was seconded by Dr. H. HAMSHAW THOMAS, M.B.E., F.R.S., and being put to the meeting was carried with acclamation.

The Scrutineers of the Ballot, who had retired at the appointed times with the voting-lists for the election of the Council and of the Officers, having completed their scrutiny, reported to the President, and he declared the result as follows :—

COUNCIL FOR 1934-35.—The Lord Aberconway, C.B.E.; Dr. Eric Ashby; Dr. W. T. Calman, F.R.S.; Prof. G. D. Hale Carpenter, M.B.E.; Dr. S. E. Chandler; Mr. Francis Druce; Prof. J. Stanley Gardiner, F.R.S.; Mr. S. Garside; Mr. J. Hutchinson; Mr. H. A. Hyde; Dr. Stanley Wells Kemp, F.R.S.; Mr. N. B. Kinnear; Dr. Margery Knight; Mr. Ashley G. Lowndes; Prof. E. W. MacBride, F.R.S.; Mr. John Ramsbottom, O.B.E.; Dr. Hugh Scott; Dr. Macgregor Skene; Dr. H. Hamshaw Thomas, M.B.E., F.R.S.; Prof. F. E. Weiss, F.R.S.

(The retiring Councillors were Dr. G. S. Carter, Prof. H. S. Holden, Prof. W. Neilson Jones, Miss E. M. Wakefield, and Mr. A. J. Wilmott.)

OFFICERS FOR 1934-35.—*President*: Dr. William Thomas Calman, F.R.S.; *Treasurer*: Mr. Francis Druce; *Botanical Secretary*: Mr. John Ramsbottom, O.B.E.; *Zoological Secretary*: Dr. Stanley Wells Kemp, F.R.S.

Thereafter the President declared the Session of 1933-34 closed.

PRESIDENTIAL ADDRESS.

By PROFESSOR F. E. WEISS, D.Sc., F.R.S., P.L.S.

THE NORTHWARD EXTENSION OF THE
MEDITERRANEAN FLORA.

(With 4 Text-figures.)

INTEREST in the Mediterranean region is not limited to any special group of inquirers. The Mediterranean has cast its spell on all who study prehistory and history, literature and art. It is the cradle of the Christian religion and the fount of European civilisation, whether we derive it directly or indirectly from Egypt. Indeed Professor Elliot Smith, who traces Western civilisation directly to Egyptian influence, indicates the close relationship of the prehistoric inhabitants of southern Europe, and even of Britain, with the ancestors of the Egyptian race, the Proto-Egyptians.

Biologists have long been interested in those striking examples of plants and animals typical of the Mediterranean flora and fauna which are found scattered, sometimes in isolated positions, in northern countries. In the British Isles the most striking example is the presence in western Ireland of a number of plants and animals of Mediterranean origin, which are not found in England nor, indeed, in northern France, a country with direct land connection with the Mediterranean region. I need not make a complete enumeration of these, as they have been so exhaustively treated both by Dr. Praeger from the botanical, and by Dr. Scharff and Dr. Carpenter from the zoological point of view. To mention a few only I might cite among the animals :—

The Kerry slug (*Geomalacus maculosus*), confined in the British Isles to south-western Ireland and unknown north of north-western Spain; two earth-worms of the Spanish and Mediterranean region (*Allophora veneta* and *A. georgii*), apparently unknown in England or France, and a Weevil (*Otiorynchus auropunctatus*) which does not occur north of the Auvergne in France. A full account of these and other Mediterranean forms of the Irish fauna will be found in Dr. Scharff's 'History of the European Fauna'.

Of the plants the most striking are the Strawberry Tree (*Arbutus Unedo*), the Mediterranean Heath (*Erica mediterranea*), St. Dabeocs Heath (*Daboëcia polifolia*), a Butterwort (*Pinguicula lusitanica*), the Orchid (*Neotinea intacta*), and, curiously enough, the London Pride (*Saxifraga umbrosa*), not a native of our metropolis but like the nearly allied Kidney Saxifrage (*Saxifraga Geum*) found in shady places

in Portugal, Western Spain and the Pyrenees, elsewhere native only in western and south-western Ireland.

All these plants and animals from their normal occurrence in the Iberian peninsula have been called Iberian elements of the British flora or also 'Lusitanian', the name being taken from one of the three provinces of Spain under the Roman Emperor Augustus.

How can we explain the occurrence in Ireland of these plants and animals evidently of southern origin? It is not merely a question of climate, for we must find out how they reached their present quarters in the west of Ireland. It is well known from fossil plant remains of Tertiary times that the climate of Britain was then far warmer than it is at the present day and if, as suggested by Edward Forbes, the above-mentioned plants represent the remains of the miocene flora and fauna they may have migrated into Ireland, possibly over some now sunken land connection between Spain and Ireland, since so many of the plants and animals referred to are not found in France. Possibly they were in those early times present also in England, but the supervening glacial period may have driven them out of the rest of the British Isles and have preserved them exclusively in the milder regions of the west of Ireland. Dr. Praeger, who last year devoted his presidential address to the Irish Academy to this problem, seems to be of this opinion, for he concludes:— 'that much of our present flora and fauna reached Ireland over land surfaces either during interglacial times or later times after the ice had passed away and that certain plants including American and probably Lusitanian are older than these and have survived the main glaciation.'

It is asserted, however, by geologists that the main glaciation of the Ice Age covered the whole of Ireland, and it has therefore been suggested by some who favour a preglacial origin of the Lusitanian types that possibly there was at that time a western extension of Ireland on which these plants and animals might have persisted, while the present land area of Ireland was buried under the ice sheet. It is true that the sea-level was not constant during glacial times, and it has been assumed that times of glaciation coincided with elevation and inter-glacial times with submergence of land. It has been contended, indeed, that the uplift of continents is necessary to induce glaciation, and Holst has postulated a lift of about 2000 m. in Scandinavia. But Charlesworth*, after discussing in detail these geological suggestions, concludes that the only forces which affected the sea-levels were due

* Charlesworth, J. R., 'Some Geological Observations on the Origin of the Irish Fauna & Flora', Transactions of the Royal Irish Academy, vol. xxxix, p. 358, 1930.

to the ice-sheets themselves, and that off the western and southern coasts of Ireland the glacial sea-level was lowered only some 130 m. He also concludes that any such slight extension of the Irish coast was covered by the ice-sheet. In his opinion survival of Lusitanian plants off the west coast was impossible, and off the southern coast just possible but improbable, as only the hardiest species could survive.

Praeger, in support of his contention of their survival, quotes the fact that *Neotinea* occurs at present in Clare at a height of 1,000 ft., *Erica* at an altitude of 1,000 ft. in the Galway Mayo area and *Daboëcia* at 1,900 ft., and in the Pyrenees is under snow for five months. In Kerry *Saxifraga Geum* occurs at 2,650 ft. and *Saxifraga umbrosa* is a mountain plant in Donegal reaching 3,300 ft. in Kerry and 2,680 ft. in Mayo.

Still these plants are all very different in character from those we should expect in comparatively near proximity to ice sheets. In Devonshire, which was free from ice even at the period of the greatest extent of glaciation, some clays deposited during the glacial period reveal that at that time this ice-free region had a characteristically arctic flora, including the Dwarf Birch (*Betula nana*) and the Bear-berry (*Arctostaphylos Uva-ursi*). Similar remains of arctic plants of Glacial age were discovered in London in a section exposed in the foundations of the New Admiralty Offices in 1892, while deposits of the same age in Scotland and Yorkshire, all within the glacial area, have revealed numerous arctic plants which, with the exception of *Salix polaris*, are still to be found in the mountains of Scotland*. It seems, therefore, very difficult to imagine that the Mediterranean plants of Ireland would have survived during the period of maximum glaciation. A persistence of the Lusitanian plants of the Irish flora during the period of maximum glaciation is, it seems to me, only conceivable if we adopt wholeheartedly the existence of an Atlantean continent as has been suggested by Mr. Forrest†. According to this writer, who bases his theory on geological data, Europe and America were connected at the time of the Ice Age by a continental area stretching from Iceland in the north, where it reached an elevation of 17,000 ft., to the Azores in the south. While he invokes a high altitude of this continent in the north to explain certain phenomena of glaciation in Ireland and Scotland, its southern unglaciated portion might have served as an admirable place of retreat for the Lusitanian plants during both glacial periods.

* See Clement Reid, 'The Origin of the British Flora'.

† Forrest, H. Edward, 'The Atlantean Continent', London, 1933.

There is, however, a further possibility to be considered. Did these Lusitanian plants migrate into Ireland during the last interglacial period, which was followed by a glaciation of less severity leaving a considerable portion of the south of Ireland free from ice? This interglacial period was characterised by a comparatively warm climate even as far north as Scandinavia, for Nordhagen* states that in Denmark, south Sweden and Finland, *Trapa natans*, a native of central and southern Europe, occurred in this interglacial period, and in Denmark *Aldrovanda vesiculosa*, an insectivorous aquatic now confined to southern Europe. The sycamore (*Acer campestre*) and the lime (*Tilia platyphyllos*) flourished in Denmark and sheltered the Fallow Deer (*Cervus dama*), a native of the Mediterranean and the Near East. In Britain, too, the interglacial remains examined by Clement Reid in the southern and eastern counties of England have revealed, in addition to plants still living in these districts, the presence of such southern forms as *Acer monspessulanum*, a sycamore characteristic of the Mediterranean, *Naias minor* and *Naias graminea* both southern forms and the latter, a native of stagnant waters in the hotter regions of Asia and of Egypt. There are no northern species associated with these interglacial remains, and the mammals and mollusca found in connection with them suggest a climate drier and warmer than that of the south of England at the present time. Nordhagen thinks it possible that the Lusitanian plants might have migrated into Britain during this warm interglacial period, when they may have existed over a considerable portion of the adjacent continental area. We have no proof of their immigration at this period as most of the interglacial plant-bearing deposits available are of an aquatic nature.

Charlesworth, in his 'Origin of the Irish Fauna and Flora',† discusses this possibility very fully. During the last interglacial period called by him the 'Aurignacean oscillation', he agrees that there was an amelioration of climate which encouraged the immigration of both animals and plants. The remains of the former found in Irish caves south of the line of the end moraine include those of the Mammoth, the Cave Hyena, the Arctic Lemming, the Irish Elk, Reindeer, Bear and Arctic Fox, and towards the close of the period Magdalenian man. There must naturally have been plants, too, for the food of the herbivorous animals. The temperate interglacial bed of Hoxne in Suffolk is probably contemporaneous. It included several species of *Ranunculus*, Raspberry, Elder, Nettle, Hazel and Hornbeam, Yew, Wild

* Nordhagen, Rolf, 'De Senkvartaere Klimavekslinger i Nord-europa', Oslo, 1933.

† Loc. cit.

Rose, etc. There is the possibility, therefore, that the Lusitanian plants may have gained a footing in the warmer regions of the west.

But should this have been the case we still have to consider whether these immigrants could survive during the cold



FIG. 1.—The area in the British Isles covered by ice during the last glacial period is indicated by the dotted line. The area in Ireland is shown by hatching.

of the last (Early Magdalenian) glaciation (see fig. 1). The latter was not as extensive as the previous one, and the much greater area for the retreat of these plants to the south was

more favourable than during the earlier Mousterian glaciation, but the climatic conditions were severe. This is indicated by the arctic nature of the flora of this period as revealed by the plant remains in Suffolk and Cambridgeshire and the Lea Valley of Essex recorded by Clement Reid, including as they do *Salix polaris*, *Betula nana*, in addition to plants of the present flora of these districts. Lloyd Praeger's contention that the Lusitanian plants survived such glaciations receives some support from the considerations put forward by Wilmott*. Basing his conclusions on the data of plant distribution in Britain, including that of Atlantic and Mediterranean plants, Wilmott comes to the conclusion that they are mainly survivals from pre-glacial times and not post-glacial immigrants. He considers that the assumption of the extinction of the older flora is generally not supported by any definite evidence.

We ought, perhaps, also to consider to what extent former views concerning the severity of the climate during the Ice Age need revision in the light of the views put forward by Simpson†. According to this meteorologist the glacial periods may have been caused by increased solar radiation, which, while causing greater evaporation in the equatorial regions, may have caused greater precipitation in the polar regions. Snow would therefore at first accumulate in northern latitudes faster than the summer heat could melt it, causing comprehensive glaciation, while a further increase in solar radiation would bring about the warm humid atmosphere of the interglacial period. Regions not actually glaciated might therefore have had a comparatively warm climate. On geological evidence, however, Charlesworth has concluded that during the period following upon the last glaciation the central plain of Ireland must have resembled much of Finland of to-day, as it was covered with vast shallow lakes dotted over with countless islands formed by the summits of the eskers. According to Erdtman's investigations of the pollen preserved in the peat, birch and willow predominated as they did in England and the other countries that had been glaciated. Later, hazel, elm and oak immigrated into Ireland.

Below the peat in Ballybeagh Bay, Co. Dublin, are found subarctic forms, reindeer among the animal remains and the leaves of *Salix herbacea* and pollen-grains of *Myriophyllum*. The White Bay at Killough, Co. Down, has yielded stunted forms of mollusca similar to the arctic forms of Greenland,

* Wilmott, A. J., 'Concerning the History of the British Flora', 'Contribution à l'étude du peuplement des Îles Britanniques', Paris, 1930.

† Simpson, G. C., Mem. Manch. Lit. & Phil. Society, vol. lxxiv, (1929-30).

of Europe and America, and *Myriophyllum alterniflorum*, which is considered to be an index fossil of the oldest postarctic sediments of N.W. Europe, has been found in Sloggan Bog, Co. Antrim.

What positive evidence we have therefore points to the early postglacial plants as of arctic character, as is the case in England and Scotland too. That Mediterranean plants should have survived in the south of Ireland during the last glacial age is therefore very problematical. Stapf considered this Lusitanian element of the Irish Flora as part only of a larger Mediterranean group of plants which, together with a number of Atlantic types, make up the southern element in the British Flora. The Atlantic types, which are found along the shores of the Bay of Biscay and northwards on both sides of the English Channel, are mostly hygrophilous forms. They are more numerous in Ireland than the drought loving true Mediterranean forms and are numerous in Wales, the Lake District and even beyond the Solway. The Mediterranean element proper, as distinguished from the Lusitanian forms in Ireland, is most common on the south coast of England, where it exceeds the Atlantic element in number of species. Most of the Mediterranean species found in Britain show, according to Stapf, some degree of continuity of distribution. Thus on maps which he showed to this Society in 1916 he demonstrated that the Wild Madder (*Rubia peregrina*), for example, was found continuously all through France to the Mediterranean, while its distribution in Spain, Italy and northern Africa proclaims it to be a true Mediterranean plant. Among some of the Mediterranean plants found in England, as well as in Ireland, is the Asparagus (*Asparagus officinalis*) found on the maritime sands all round the Mediterranean and reaching up the western coast of Europe to the English Channel. Here it is confined to the southern and western coasts of England and to the coast of Wexford and Waterford in Ireland. It cannot be considered a purely Atlantic type, as it occurs on the eastern Mediterranean and is also found in the Valais of Switzerland.

Some of the orchids like the Bee Orchis (*Ophrys apifera*) and the Lizard Orchis (*Loroglossum hircinum*) confined to our southern counties are of Mediterranean origin. So is *Arum italicum*, the leaves of which, like those of other Mediterranean plants, appear in the autumn. It is absent from northern France but is found in Dorset, Sussex and Kent in such natural surroundings that Dunn*, who is generally very diffident about admitting southern plants as natives, includes it in our native flora. These are some only of the Mediterranean plants native to this country. I need not mention more.

* Dunn, S. T., 'Alien Flora of Britain'.

Stapf, in his account of the southern element in the British Flora, refers to others, and though he insists that they must be taken together with the Lusitanian plants of Ireland in any discussion of their entrance into the British Isles, he unfortunately does not commit himself as to the time and manner of their immigration. We must choose between the possibility of their having spread northwards during a warm interglacial period, surviving the last glaciation and a post-glacial immigration. The former alternative seems to me very problematical, the latter more possible, since the geologist Wright has indicated that there was a connection between England and France later than the last (Würm) glaciation.



FIG. 2.—The Scandinavian peninsula showing the region (hatched) of the present distribution of the Hazel (*Corylus*). The dotted area represents the additional area of distribution during the early and warmer postglacial period. (After Nordhagen.)

The Straits of Dover may not have been cut until the Magdalenian period; but, on the other hand, the connection may have been an intermittent one due to changes in sea-level. Also, it is generally accepted that after the last glacial phase there was a period of time with a warmer climate in northern Europe than we enjoy at present, and this would have favoured an immigration of southern forms. It has been shown, for instance, that in the earlier postglacial times the Hazel extended further north than it does today in Scandinavia (see fig. 2). The same applies also to the Waterchestnut (*Trapa natans*) and to a freshwater tortoise (*Emys orbicularis*). Quite possibly a large number of Mediterranean

plants entered the British Isles, and their number may have been reduced by the colder weather which supervened.

If we accept Stapf's view that the Lusitanian plants of the west of Ireland are only part of the Mediterranean element which made its way at some time possibly postglacial into Britain, we ought to have some explanation or indication why such forms as *Erica mediterranea*, *Arbutus* or the London Pride did not survive in the south and south-west of England, where we know that climatically they grow very well under cultivation. The only explanation would be that they had been unable to compete with the hardier Germanic and Gallic types. It is not a very strong argument, however, considering the numerous Mediterranean types which have managed to survive in the south of England, particularly in Devonshire and Cornwall. The alternative to both the theory of survival of the Lusitanian types in Ireland during the last glacial period, their immigration with the Mediterranean plants into Britain over a land bridge in early postglacial times, is the arrival of these plants in Ireland by means of seed dispersal from the south west. In this connection it is a remarkable fact that they are all but one characterised by the smallness of their seeds, and while it might be difficult to imagine that these seeds could be carried by the wind from Spain or Portugal, or even western France, small seeds would more readily adhere to the feathers or feet of birds flying over this region of the sea than large ones. The only one of the Lusitanian plants with large seeds is the *Arbutus*, but this has a fleshy fruit, so the seeds might have travelled as inside passengers.

Whether this suggestion will seem to you more plausible than the suggestion of their survival during the last glacial epoch I cannot say, and I think we shall have to leave the matter as a still unsolved problem like so many Irish problems.

The northward trend of Mediterranean plants in France is more easy of explanation than is their occurrence in Britain. In the first place France was not, like the north of England, covered with glaciers during the Ice Age. Only a comparatively small complex of glaciers, which were formed around the Mont Dore in Auvergne, indicate a lowering of the temperature during that epoch. That the climatic change which brought this about must have adversely affected the earlier more temperate flora of the tertiary period is certain, as is proved by the fossil remains of the Miocene plants in France. But during the warmer interglacial phase and in postglacial times the southern forms had a free land passage to such parts of northern France as were suited to their requirements. Possibly at an earlier period either interglacial or postglacial of greater warmth many more had

spread northwards but have gradually disappeared again or have been left as relicts in certain localities, thus giving instances of discontinuity of distribution.

The dying out of the intervening plants would be a slow and discontinuous process. Martin, who, like other French botanists, believes that a number of the existing Mediterranean plants are of miocene origin, supposes that in those times they extended to the north of France and to Switzerland, but during the colder pliocene and pleistocene times they have been killed out. Even at Montpellier, as he states, some tend to die out now in severe winters.

In their northward passage through France the various Mediterranean elements have taken different routes determined in part by their original distribution along the French shores of the Mediterranean. Some have passed along the mild Atlantic coast, a few of the hardy ones over the central high plateau but the majority up the Rhone Valley.

Flahault, in his account of the Vegetation of France in Coste's 'Flore de France', distinguishes three divisions of what he calls the Mediterranean region of France: (1) the western division with Iberian affinities; (2) the eastern with Italian affinities; and (3) a central division at the mouth of the Rhone which in the Mediterranean flora is mixed with numerous northern types. In certain areas these last may amount to 50 per cent but the flora still maintains the Mediterranean facies. But just as northern types of vegetation have descended down the Rhone Valley so many Mediterranean elements have spread northwards, gradually diminishing as the climatic conditions change. For the truly Mediterranean plants are adapted to the dry and hot summer and the comparatively wet winters of the Mediterranean region. The flora of the Atlantic coast of southern France is really entirely distinct from the Mediterranean, for though the summers are hot there is heavy precipitation of moisture during that season and the flora is classed as Atlantic. It contains a vegetation not dissimilar to that of Cornwall or the west of Ireland, including such plants as *Erica vagans* (the Cornish Heath) and *E. ciliaris* and some like *Erica mediterranea* which, though a Mediterranean type can, as we have seen, adapt itself to the moist conditions of the west of Ireland. Among other southern plants which have taken this western route northwards along the coast and which are classed by Stapf and Flahault as Atlantic elements, may be mentioned *Corydalis claviculata*, found in northern Portugal and Spain, is common in the whole of western France and reaches Belgium, Holland and even Denmark. It is, of course, common in England and Wales, and reaches into Scotland. It may be considered a truly Atlantic type.

Simethis bicolor, on the other hand, like *Erica mediterranea* is a Mediterranean plant occurring on the north coast of Africa, and though limited in the Iberian peninsula to Portugal and the north of Spain, occurs in southern France both on the Mediterranean and the Atlantic side. It passes up partly along the western coast but also through central France, reaching Brittany and having one solitary station on the Seine. Then it turns up in Kerry in Ireland.

Comparatively few plants have spread northwards from the Mediterranean across the central high plateau of the



FIG. 3.—The course of the northward passage of Mediterranean plants is indicated by arrows.

Auvergne. For though it has hot and dry summers like the shores of the Mediterranean it is exposed to severe frosts in winter, which have probably destroyed many Mediterranean plants which may have extended there in earlier times. Lecocq, in his special study of this region in relation to the plant geography of Europe in general, mentions among the Mediterranean elements several species belonging to the Cistineae, Linaceae, Terebinthaceae, Plumbagineae and Thymelaceae, that is, the smaller and hardier of the Mediterranean

plants, while some species of *Cistus* (*C. albidus* and *C. laurifolius*) reach north on the central plateau only to the 44th degree of latitude. *Cistus salvifolius* is probably the most widespread in France, reaching the island of Noirmont in Brittany. *Helianthus umbellatus* is found as far north as Paris. A similar range is that of *Linum*, a genus most abundant in its distribution in the Mediterranean area. *Linum narbonense*, known from Algeria and Corsica, is found only in southern France, and does not penetrate to the central plateau. *Linum strictum* reaches the latter but extends no further. *Linum gallicum* widely distributed over Spain, Italy, Algeria and the Canaries, has its northern boundary at Nantes. *Linum salsoloides* reaches the 47° and *Linum angustifolium*, which according to de Candolle belongs to the western Atlantic region of *Erica ciliaris* and is found in Spain and Algeria, Italy and Greece, extends up western France to southern and western England as far as Lancashire.

Thus we see that in France the distribution of the Mediterranean plants is on the whole regular and determined by climatic factors, the absence of many on the south-western region being due to the comparatively wet summers and their absence from central and northern France to the frost of the winters.

As already stated, by far the greater number of the truly Mediterranean types have proceeded northwards along the Rhone Valley more suited to their special adaptation to a dry summer and a moist winter. Many of these are found in the hot valleys of the Dauphiné running eastward out of the Rhone valley into the Cottian Alps. Some have reached Geneva and Haute Savoie. As a single example I might mention *Gladiolus segetum*, so familiar to visitors to the Riviera in spring. It is found near Geneva and in Savoie. Other plants have followed the Valley of the Saone from its confluence with the Rhone at Lyons and have descended over the Plat de Langre into the Marne basin and have thus penetrated into the north of France and into Belgium. Or, following the river Doubs (see fig. 3) where it joins the Saone, they have passed into Alsace and the upper valley of the Rhine. Probably both these routes were taken by the Box (*Buxus sempervirens*), a typical hard-leaved Mediterranean plant ubiquitous in the limestone regions, which has stretched north as far as Normandy whence probably it migrated into Britain. It has also spread into Belgium and Holland, is particularly widespread in the Jura and is found in Alsace and in Baden.

The plain of the Upper Rhine from Basle to Mayence since the war divided politically into French and German territories, Alsace and Baden respectively, represents botanically one region,

the richest in central Europe in Mediterranean plants. This is partly due to the hot summers of this wide river plain, the bottom of a great lake in former times, and partly owing to the comparatively low rainfall in summer, lying as the plain does in the shelter of the Vosges mountains on which the rain clouds coming from the Atlantic deposit their moisture. The rainfall at Colmar, for instance, is only 48 cm. ($18\frac{1}{2}$ inches). There has also been a convenient passage of entry for Mediterranean plants through the gap of Belfort at the head of the Doubs (see figs. 3 and 4). For this river runs into the Saone,



FIG. 4.—Map of Switzerland, showing the course of the immigration of Mediterranean plants into Switzerland and the plain of the Rhine indicated by arrows.

and the latter into the Rhone, so that there exists a through communication with the Mediterranean. A less direct approach is along the eastern base of the Jura mountains.

At the north end of this upper Rhone valley, between Mannheim and Mayence, there is a large collection of somewhat xeromorphic plants of southern and south-eastern origin, which Jaenicke considers relicts from the time when this was connected with the Mediterranean both in a southerly and a south-easterly direction. The majority of these relicts forming 40 per cent of the flora are characteristic of south-eastern Europe and the steppes of southern Russia, such plants,

for instance, as *Onosma arenarium*, *Kochia arenaria*, *Alsine Jacquini* and *Trinia vulgaris*. But some 27 per cent are more purely southern forms, which seem to thrive in the hot dry plain on both banks of the Rhine between Basle and Mayence. Among these may be mentioned such southern forms as *Helianthemum Fumana* Mill., *Dianthus Carthusianorum*, which has a fairly wide distribution in Europe except Scandinavia and Britain, *Bupleurum falcatum*, *Verbascum phlomidoides* and *V. Lychnitis*, *Stachys recta*, *Armeria plantaginea*, and *Allium sphaerocephalum*. Possibly some of these plants, though southern types, may not be considered purely Mediterranean species and they are sometimes called sub-Mediterranean. *Armeria plantaginea*, for instance, though found in Dalmatia and northern Italy and Spain, is rather of the Atlantic shore type, being found in western as well as southern France and passing up into the Channel Islands. Still, though occurring sporadically in the sandy regions near Mayence it probably owes its occurrence there to the same causes as the other more definitely Mediterranean types. Whether these southern forms really persisted, as Jaennicke supposes, during the last glacial period seems problematical. It is true that this plain of the Rhine was not itself covered with ice during the last glacial period, but glaciers from both the Vosges mountains on the west and the Black Forest on the east descended to the edge of the plain, and remains of arctic plants such as *Dryas octopetala* and *Salix herbacea* have been found at Rümplingen at the southern end of the Black Forest. Still Jaennicke suggests that some of the Mediterranean plants which had made their way there during the last interglacial period, which as we have seen is generally accepted to have been a warm one, may have lasted out during the last glacial epoch. Others may have pushed northward after the ice had disappeared, particularly during the comparatively warm and dry period which immediately followed. Some of these coming up the Rhone Valley may have come along the slopes or at the foot of the Jura entering the Rhine plain at Basle, as Hegi supposes; but it seems more likely that the majority of them, as has been emphasised by Braun-Blanquet, entered the plain of the upper Rhine through the portals of Burgundy, i. e., from the Rhone Valley they passed up the Saone and the Doubs and penetrated into the plain near Belfort (see fig. 4). In favour of the western route round the foot of the Jura may be mentioned the occurrence on the Küssaberg near Waldshut on the Rhine, between Basle and Schaffhausen, of *Scorzonera austriaca*, the only station in Germany for this plant. Similarly on the Isteiner Klotz, near Baden, is the only German station of the Mediterranean Sedge, *Carex Halleriana* Asso (*Carex*

alpestris All.), which is found on the Jura in the cantons of Neuchâtel and Basle. On the other hand, Braun-Blanquet points out that the Rhine plain contains many Mediterranean species not found in northern Switzerland such as *Koeleria Vallesiana*, *Scilla autumnalis* and *Artemisia camphorata*. Braun-Blanquet even suggests that some of the Mediterranean forms may have migrated into northern Switzerland from the plain of the Rhine so rich in these southern types. That their immigration by way of the gap of Belfort must have taken place long before historic times is indicated by the present comparatively high rainfall on the pass of Belfort. But though the rainfall here is considerable, in the Rhine plain in the shelter of the Vosges mountains it is very low, being less than 20 inches in Colmar. Here we find among the characteristic plants: *Coronilla Emerus*, *Colutea arborescens*, the Bladder Senna, which according to the 'Treasury of Botany' is said to grow even on the crater of Vesuvius, where there is little other vegetation, *Orobanche amethystea* (not found in Switzerland), the Man Orchis (*Aceras anthropophora*) and the Lizard Orchis (*Loroglossum hircina*).

On the German side of the Rhine conditions are not quite so favourable as in Alsace, the rainfall being somewhat higher, but the solitary Kaiserstuhl rising out of the Rhine plain near Freiburg is particularly rich in Mediterranean forms, including *Orchis Simia* and *Colutea arborescens*, the latter not found elsewhere in Germany.

Another and more northern region rich in Mediterranean plants is, as pointed out before, the Valley of the Moselle, carrying down some of them to the middle region of the Rhine. The Moselle valley is no doubt also connected with the Rhone-Saone route, and Dr. Christ has already drawn attention to this northern passage of Mediterranean plants, citing *Acer monspessulanum* as one of the pilgrims along this route. In the Rhone Valley itself it reaches its northern limit just south of Geneva, but is found along the Saone, and again on the warm slopes of the Moselle together with *Prunus Mahaleb* and *Buxus sempervirens*. Among the Mediterranean plants of this Moselle region may be mentioned: *Helianthemum appeninum*, *Armeria plantaginea*, *Verbascum floccosum*, *Scorzonera laciniata*, while *Sedum rubens* L. reaches only as far as Treves and *Ruscus aculeatus* only to Metz.

Eastward of the Rhine comparatively few Mediterranean forms have penetrated into Germany. Some montane forms, such as *Alyssum montanum*, have spread from the Jura across the Rhine to the Swabian Alps, but in northern Germany climatic conditions are unfavourable to southern vegetation, and in eastern Germany the southern forms are mainly steppe plants from southern Russia, the so-called sarmatic elements.

Favoured positions with warm climate for these and other southern forms are the Hegau north of Schaffhausen with *Nepeta nuda*, and Thuringia in central Germany, north of the Main. The Mediterranean or southern forms it contains have no doubt come via Switzerland, for *Isatis tinctoria*, *Astragalus vaginalis*, *Inula hirta* and *Nepeta nuda* occur in Switzerland as well. The country round Regensburg on the Danube also contains a number of southern and south-eastern plants. These may owe their origin to transit over the eastern Alps, for Chodat and Pampanini have shown that quite a number of plants are distributed both to the north and south of these mountains, many Mediterranean plants making their way into Austria over the Tyrolese mountains being found in the Voralberg and also in the Salzburg region.

It might be considered that Switzerland, the major part of which was glaciated by a great extension of its glaciers, could show no relicts of an ancient Mediterranean flora. Probably that is correct, and the southern forms which actually occur must have immigrated since then. But how and along which lines they have come has been much debated.

My own personal interest in this matter was aroused by finding the southern form or subspecies of *Polypodium vulgare* known as *serratum* in company of our Fellow, Mr. Paul Kestner of Lausanne. This southern form of the common Polypody was considered as a subspecies by the late Dr. Hermann Christ of Basle, and it is regarded as a Mediterranean type. I have collected it in Sicily and in the Swiss Canton of Ticino on the south side of the Alps. It is also found in the western Mediterranean Region, in the Canaries and the Azores. Christ, in his 'Farnkraeuter der Schweiz', states that apart from the serrate margin of the upper pinnae it is characterised by possessing several vascular bundles in its petiole in place of one. But in addition to these morphological differences its biological differences are even more striking. While in the Common Polypody the young leaves begin to develop in spring and produce ripe sori in the summer, *Polypodium serratum* produces its new fronds late in the summer and has green leaves during the winter, the sporangia ripening in the spring. Thus it is adapted to the wet autumn and winter of the Mediterranean region, its old leaves being dry and shrivelled during the prolonged drought of the summer. It is true that Litardière, examining this species both from the morphological and biological point of view, has concluded that these differences are not constant, and regards *Polypodium serratum* merely as a varietal form. As a matter of fact in cultivation the distinction between the two forms is not always so clearly marked as regards the time of appearance of the fronds; but at the eastern end of the Lake of Geneva

a little way up the hot Rhone Valley, where Mr. Kestner showed me both forms growing in the same little woodland, the difference was obvious.

M. Farquet, a lay brother of the St. Bernard Monastery and resident at Martigny, who has spent much time in studying intensively the flora of this interesting district, and has an accurate knowledge of the many forms and varieties of *Polypodium*, states that the subspecies *serratum* reaches its most perfect development in winter between the months of October and March, when the fronds of the ordinary polypody are withered or killed by the frost *. It is usually seen at its best in the first fortnight of January unless there has been an exceptionally frosty period in the valley. These fronds become dry in the summer and protect the young fronds which appear late in the season. It is thus a plant showing even in its northern home the vegetative rhythm of Mediterranean plants.

Polypodium serratum is, however, only one of the many Mediterranean elements inhabiting this upper valley of the Rhone. In the same woodland where I found it there was growing *Ruscus aculeatus*, which stretches down along the Lake of Geneva to Chillon, and after a break can be found again in the lower Rhone Valley below Geneva. From their distribution one might conclude that these southern forms had made their way up the lower Rhone Valley and along the shores of the Lake of Geneva to the upper Rhone Valley where they reach their northern limit in Switzerland. Indeed, Christ says :—‘To assign to the vegetation of the lower portion of the Canton Valais its true place in the general distribution of species one can look upon the valley of the Rhone, from its origin down to the sea, as an uninterrupted region of which the Canton Valais is the upper part. The floral types of the warmer regions have penetrated into this warm and sheltered enclosure as they have penetrated into the lateral valleys of the Dauphiné.’ Our distinguished foreign member, whom we have so recently lost, the late Professor Chodat, however, was strongly of the opinion that most of the Mediterranean plants found in the upper Rhone Valley have come over the Alps by way of the numerous passes, particularly the Great St. Bernard, either during interglacial periods or postglacially into the Valais.

As regards *Polypodium serratum* I hunted for signs of it at Chamonix and Finhaut the routes leading down to Vernayaz and also on the Col de la Forclaz leading down to Martigny, but with negative results. Farquet states that it is limited in its distribution to the valleys. Though the light spores

* Farquet, Ph., ‘Le Mont d’Ottan près Martigny. Étude phytogéographique’, Bull. de la Murithienne, 1929.

might have been carried over the mountain tops, it would appear as if this plant had made its way by the lower Rhone Valley to the region which afforded the conditions of successful growth and reproduction. I believe this is also true of *Ruscus aculeatus*. The other Mediterranean plant of the upper Rhone Valley in which I have taken a particular personal interest is *Ephedra helvetica*. Here we have the case of a peculiar xeromorphic form of the Gymnosperms, of switch-like growth, of which the Swiss species represents a comparatively low growing form. The genus is widely distributed along the shores of the Mediterranean and one species is common on the shores of S.W. France. The only Swiss species, *Ephedra helvetica* of C. A. Meyer, is found on the dry rocky hillocks of the upper Rhone Valley. I have seen it on several visits to Sion, growing in comparative profusion on the little rocky elevation on which stand the ruins of the Château de Valère. The short leafless branches browsed off by the goats render it difficult to find except when its small coral-like fruits are ripe in the summer. The Swiss species formerly regarded as endemic was united by some French botanists to the species *Ephedra polystachya*, of which it was regarded as a variety not merely confined to Switzerland but occurring also in France. Stapf, however, in his monograph of the genus, distinguishes *Ephedra helvetica* of Meyer as a definite species, though not confined to Switzerland but occurring also in Piedmont, where it is found in the Valley of Aosta. Its occurrence there supports Chodat's contention of the passage of southern forms across alpine passes into Switzerland, for the seeds attractive by the red succulent scales by which they are surrounded could readily have been transported by birds either across the mountains or by way of the pass of the St. Bernard. In the hot dry valley of the upper Rhone the plant has found a most suitable substitute for the Mediterranean climate.

There would, therefore, be two definite routes of immigration of southern forms into Switzerland, and Braun-Blanquet, in his communication on the floral elements of Switzerland to the Swiss Naturforschende Gesellschaft Meeting at Basle in 1927, definitely accepts both the gradual passage of plants up the Rhone Valley and by way of the Lake of Geneva, and also the passage across the Alps. The southern and northern distribution of each individual species would have to be considered before a decision could be come to as to the probable route it had taken. In studying this problem Chodat, with the possibilities of his Alpine station at Bourg St. Pierre on the pathway to the St. Bernard, was in an excellent position for undertaking such studies, and he and some of his pupils have interested themselves in this matter.

In conjunction with R. Pampanini he has published a detailed account of the distribution of plants of the eastern Alps, in which he shows that many of the forms found on the southern slopes of the eastern Alps and on the slopes of the Adriatic, are found also on the northern side and, indeed, as far away as Voralberg and Salzburg. They also dwell on the penetration of the high valleys on the southern slopes of the central and western Alps by plants of Mediterranean origin, and judge from the direction of their distribution that the penetration took place in interglacial periods. In many places the plants are also found north of the Alps. Some of these plants are alpine plants, and their distribution across the alpine chains is more or less natural, but in other cases, such as those of *Asphodelus albus* and *Saxifraga bulbifera*, they are both found in the depth of the Rhone Valley, their only station in Switzerland, and though they are found in some of the alpine valleys of Savoie they are not found in the main Rhone Valley below the Lake of Geneva. Their distribution, therefore, certainly supports Chodat's contention that they have made their way across the Alps. The same is true of a number of other plants, of which Chodat and Pampanini give the distribution, on both sides of the Alps. These, though of a diversity of origins, they conclude have penetrated into the upper Rhone Valley from the south-west. They are *Viola pinnata*, *Douglasia Vitaliana* southwards from Lenck, *Minuartia rupestris*, *Silene vallesia*, *Astragalus leontinus*, and *Astragalus monspessulanus*, both of which occur in the Val d'Aosta on the south of the St. Bernard and also in the Rhone Valley north of it.

From these facts Chodat and Pampanini assert the continuity of the floras of the Valais and Piedmont. They are, indeed, so greatly impressed by this continuity that they unite floristically, under the name of 'le Massif du Piémont', the Pennine Alps of the Valais from Martigny to the massif of the Grand Paradis in the Grayan Alps and the Viso.

One of the reasons of the persistence or existence of Mediterranean plants is the upper Rhone Valley of Switzerland is, no doubt, the light rainfall of the district, which is under 60 cm. (24 inches) at Riddes and Siders, and also at Grächen in the lower portion of the Zermatt Valley and 63 at Martigny, while it is 110 cm. at Montreux and 130, or more than twice as much, at Meiringen in the Bernese Oberland.

On the south side of the Alpine chain a similar dry zone of 60 cm. (24 inches) or less extends along the Val d'Aosta, whereas in the Ticino, the Italian speaking Canton of Switzerland, the rainfall is from 150 cm. at Airolo to 168 cm. at Bellinzona and 187 cm. at Locarno, a climate not favourable to the xerophytic types of the Mediterranean Flora.

Moreover, the period of the highest rainfall in the Valais is more like that of the Mediterranean region, for the highest maximum monthly rainfall is in October at Martigny. The same is the case for Bourg St. Pierre, halfway up the route of the St. Bernard, and at Aosta on the south side of the pass. This is also true of Binn at the upper end of the Rhone Valley. In the more northern parts of Switzerland the highest monthly rainfall is in the summer months, in June at Basle, in June and July at Meiringen, in the Oberland, in June and August on the Rigi, and July and August at Château d'Oex above Montreux. Thus in both the amount and the period of maximum rainfall the upper Rhone Valley approximates very closely the Mediterranean climate, the summers being not only hot but also dry, while the maximum rainfall takes place in the cooler months of the year.

There are, of course, southern including Mediterranean plants in other parts of Switzerland. The Engadine has a few, and here Chodat believes that they have entered via the Stelvio Pass from Italy.

As has been pointed out, a number of Mediterranean plants arriving at Geneva via the Rhone Valley can be traced along the eastern shores of the Jura. Thus the Laburnum, common in the woods of the lower Rhone Valley, is found in the Jura near Geneva and northwards to Neuchâtel, and beyond that place the Alpine Laburnum, which occurs also in the Canton Valais, is common. *Acer opulifolium*, a characteristic tree of Mediterranean woods from Dalmatia to Granada, is found in the Jura both along the Lake of Geneva to Vevey and northward to Delémont, passing also from there westward into some parts of northern Switzerland. Of the genus *Iberis*, so common in the Mediterranean, *Iberis saxatilis*, common in the Pyrenees and the Basses alpes, is found again in one or two stations on the Jura. *Vicia narbonensis*, found at Basle, has reached this locality by way of the Jura, for there are one or two stations for it there. The most widespread of the southern forms, however, is the Box, a true limestone loving plant, one of the characteristic plants of the Jura, as also is the Holly, another hard-leaved Mediterranean type. *Narcissus biflorus* and *Erythronium Dens-canis* must also be included among the southern forms of the Jura.

In the Balkan peninsula the existence of Mediterranean plants, except of the montane forms, meets with difficulties owing to the high elevation and cold winter climate resulting from it, but Stojanow refutes Adamovic's contention that the Mediterranean elements have gone back in number owing to unsuccessful competition with the northern European invaders and those from Asia Minor. He shows that southern

Bulgaria has a rainfall of 80-100 cm. falling mainly in autumn and winter, and a climate of modified Mediterranean type. Numerous Mediterranean elements have made their way up the river valleys, as has happened on the southern side of the Alps. At the foot of the Strandya mountains the undergrowth of the forests of *Fagus orientalis* contain such forms as *Rhododendron ponticum*, *Prunus Laurocerasus*, *Daphne pontica*, *Ilex aquilifolia* and *Ruscus hypoglossum*. He also indicates that a number of Mediterranean plants have made their way northwards along the low-lying land and the coast of the Black Sea.

Where so many considerations have to be taken into account, and so many conflicting views have been expressed, it is obviously impossible to deal exhaustively with every aspect of the subject. I trust, however, that I may have indicated what interesting problems a consideration of the northward extension of the Mediterranean flora involves, and how much still remains to be settled.

OBITUARIES

ERWIN BAUR (1875-1933).—Only a year ago Erwin Baur was elected a Foreign Member of the Linnean Society, and already we have to deplore the loss of this distinguished geneticist. Born at Ichenheim in Baden, Baur devoted himself to the study of medicine, and after graduation practised as a physician for mental diseases. But having been attracted during his studies to Botany he entered the university of Freiburg and was awarded the Ph.D. degree for a thesis on the reproductive organs of *Collema*, in which he was able to demonstrate the process of fertilization. Appointed to an assistantship in Botany in Berlin he subsequently became Professor and Director of the Landwirtschaftliche Hochschule of the Prussian capital. After the war he was fundamental in establishing the Institute for Vererbungslehre in Berlin-Dahlem, and in 1929 became director of the Kaiser Wilhelm Institut für Züchtungsforschung at Müncheberg. These last two appointments indicate the direction along which Baur's investigations had been directed.

Already early in the present century he had commenced a very extensive and thoroughgoing genetical investigation of *Antirrhinum*. In this genus he studied closely the Mendelian inheritance of colour and also of peloric forms, and later having collected many of the wild species in Spain and other Mediterranean countries he interested himself in the evolution of the species. He also investigated and threw a good deal of light on the infectious chlorosis of the Malvaceæ and showed that a similar pathological variegation occurred in *Ligustrum* and *Fraxinus*. He was able to prove experimentally that the white-margined forms of *Pelargonium* were of the nature of periclinal chimaeras, two layers of colourless cells from a white-leaved parent surrounding the green central tissues of a green parent. He extended his chimeral interpretation to the structure of the puzzling graft hybrids and in his 'Einführung in die Experimentelle Vererbungslehre', of which the first edition appeared in 1911, he figures clearly the chimeral constitution both of *Cytisus Adami* and *Crataego-Mespilus Asniersii*.

More recent experimental work was directed to the production of mutations in plants by subjecting them to X-rays, ultraviolet light, and extremes of temperature. He was also concerned in the production of the most suitable plants for a variety of agricultural crops. This work he was carrying out with the help of numerous skilled investigators in the flourishing institute at Müncheberg, which owed its inception to his indomitable energy and enthusiasm. His inspiring example infected all his collaborators and assistants.

Issued 27 November 1934.]

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The 'Zeitschrift für inductive Abstammungs- und Vererbungslehre', which Baur founded in 1918, will remain as a permanent memorial of his life interest, and equally of his energy, which was, however, by no means exhausted by the editorship of this important journal. For he was also editor of 'Der Züchter' and of the 'Zeitschrift für Pflanzenzüchtung'. He will be remembered also as the indefatigable organiser of the Fifth International Congress of Genetics in Berlin in 1927. That he should have died so suddenly in the midst of his active career as investigator and organiser is not only a grave misfortune for his native country but also a most serious loss to botanical science the world over.

F. E. WEISS.

JOHN EDGAR BECKETT was born in British Guiana on 1 July 1878, and was educated at Queen's College, Georgetown, where he afterwards acted as an Assistant Master for three years. He entered the Department of Science and Agriculture, Georgetown, in 1900 and was appointed Senior Agricultural Instructor in 1901, a post that he filled with conspicuous success. He resigned, however, in 1908 to accept the post of Agricultural Adviser in a large Rubber and Produce Plantation.

On the outbreak of the War, Beckett obtained a commission as 2nd Lieutenant in No. 7 Infantry Company of the British Guiana Militia, and in the following year was promoted to the rank of Lieutenant. He rendered valuable service as recruiting officer, and in training the men under his charge to a high degree of efficiency. He retired from the army in 1924 with the rank of Captain, and re-entered the Government Service as Superintendent of the Industrial School, Onderneeming, and Immigration Agent for Essequibo.

He subsequently occupied the posts of Travelling Inspector to the Department of Science and Agriculture in 1928, and Agricultural Superintendent, North West District, and in April 1933 was appointed to act as District Commissioner, North West District. In 1905 he represented British Guiana at the West Indian Agricultural Conference held in Trinidad, and in 1905-06 he visited Barbados to report on the cotton industry of that island, with reference to the advisability of extending the industry in British Guiana. He was elected a Fellow of the Linnean Society in 1919.

His death occurred at Georgetown on 24 February 1934, after an illness lasting for nearly six months. Edgar Beckett was a recognized authority on the scientific and practical aspects of agriculture in the tropics. He had spent his whole lifetime in British Guiana, and probably no one had travelled more widely over the colony or was better acquainted

with the local conditions. His untiring energy, his genial good nature, and his wide experience, combined with a particular aptitude for imparting instruction, made his advice much sought after by agriculturalists in all parts of the colony. The writer has very pleasant recollections of several journeys to more or less remote districts of British Guiana, made in his company during the years 1903-08 in connection with agriculture.

Beckett's writings include a book entitled 'Hints on Agriculture', published in 1905, and several articles, mostly on various aspects of agriculture in the tropics, which appeared in 'Timehri', 'The Journal of the Board of Agriculture of British Guiana', 'The Agricultural Journal of British Guiana', and the 'Commercial Review'. He possessed an excellent knowledge of the local plants and, in collaboration with Dr. Roth, Curator of the Museum of the Royal Agricultural and Commercial Society, he compiled a Flora of British Guiana. Dr. Roth pre-deceased Captain Beckett by nearly a year, and difficulties were experienced in finding a publisher for the Flora, but I understand that the Carnegie Institute is now making arrangements for its publication.

In Captain Beckett's death the government loses a hard-working and capable colonial servant, who will be greatly missed by his many friends in British Guiana and elsewhere.

A. W. BARTLETT.

The Rev. GEORGE RUSSELL BULLOCK-WEBSTER, honorary canon of Ely, died at his home, The Green Croft, Parkstone, Dorset, on 16 February, after a long and painful illness, at the age of 75. In the autumn of 1932, owing to failing health, he had resigned his appointments in London and retired to live in the country.

Canon Bullock-Webster was born at Hereford, 7 July, 1858, the son of Captain Bullock-Webster, of the Bombay Native Infantry. His grandfather—Edward W. Bullock—assumed the additional name of Webster in 1808, under the provisions of the will of his great aunt, widow of Edward Webster. He was educated at the Hereford Cathedral School and St. John's College, Cambridge, where he graduated B.A. in 1879, proceeding to M.A. in 1887. He was ordained in the diocese of Ely and was successively chaplain of Ely Theological College and resident chaplain to the Bishop of Ely (Lord Alwyne Compton). From 1910 to 1932 he was rector of St. Michael Paternoster Royal, in the City of London.

It was while on a visit to Ruan Minor, Cornwall, during the summer of 1892, that he first became seriously interested in the study of Botany and the special group of plants—Charophyta—to which he devoted the leisure of a busy

life. Several contributions were made during this period (from 1898 onwards) to the 'Journal of Botany' and the 'Irish Naturalist', giving the results of his observations in the field. When collecting in West Donegal, in 1916, he obtained material of a new species of *Nitella*—*N. spanio-clema*—described and figured in the 'Journal of Botany' (lvii, p. 1, 1919). Later, when we first became acquainted, he was devoting much attention to the microscopic examination of the oospore. The outer coloured membrane in almost all species exhibits a decorated surface which is an important factor in the discrimination of the various species. In 1924 he issued, with James Groves, two *fasciculi* of British and Irish Charophytes. A few months before his death he generously distributed sets from his collection to the Universities of Leeds, Bristol, and Cardiff. His collaboration with James Groves, who died last year, resulted in the preparation of what will long remain the standard authority on this difficult group of plants for the British area. The monograph, 'The British Charophyta', was published in two volumes by the Ray Society in 1920 and 1924.

Canon Bullock-Webster had a winning personality and a pleasing and gracious manner which endeared him to a large circle of friends. A man of many and varied interests he was a welcome and interested attendant at our meetings, as well as those of the Royal Microscopical Society, of which he became a Fellow in 1920. He was elected F.L.S. in 1918; at the time of his death he was Vice-President of the Ray Society.

A. W. SHEPPARD.

ROBERT CHODAT (1865-1934).—By the death of Professor Robert Chodat on 28 April the Society has lost a distinguished Foreign Member, who was elected in 1914 and was awarded last year the Linnean Medal.

Chodat was born at Moutier Grandval in the Jura in 1865 and entered the University of Geneva as a student in 1882, studying botany under Prof. Müller and intending to become a pharmacist. He proved himself to be an able student, taking his doctorate at Lausanne and returning to Geneva to assist Professor Müller in his course of systematic botany and particularly in conducting the botanical excursions. In 1889, at the age of twenty-four, he was appointed assistant-professor and two years later was promoted to a full professorship in the University of Geneva as head of the department of Botany. He took over a small department in which the teaching of systematic botany was the major part of the instruction, but introduced into this a new biological outlook, in which the cultivation of Algae and Fungi played a considerable part. Chodat developed a new technique

for the pure culture of Algae, which was successfully adopted by many algologists. As a result of his investigations he discovered numerous variations in the form of Algae brought about by different methods of cultivation described in his book on 'Le Polymorphisme des Algues'. He also published in 1902 'Les Algues vertes de la Suisse'. He was, however, not only interested in the lower forms of plant-life. In his doctor's thesis he had dealt with his favourite group of Flowering Plants, the Polygalaceae, and later, after a more complete study of this family of plants, he published a 'Monographia Polygalacearum', which he dedicated to his former teacher Prof. Müller. In 1914 he had an opportunity of spending some time in Paraguay, and published an interesting account of its Flora, dealing largely with the peculiar modifications of the plants in their adaptation to their surroundings. He also acquired a very wide knowledge of the Mediterranean flora through repeated visits to Portugal, Spain, and the Balearic Islands undertaken with his students. As a teacher Chodat was most stimulating, being not only a fluent and impressive lecturer, but infecting his students with his enthusiasm. He had considerable artistic skill, and his lectures were always richly illustrated by his own excellent drawings.

His effectiveness as a teacher can be gauged by his 'Principes de Botanique', which as a textbook for students is admirable in every way. Clear and simple in its treatment and excellently illustrated, it shows also the wide and philosophic outlook of its author. No aspect of botany was unimportant or uninteresting to him and he made valuable contributions to genetics and palaeobotany as well as to those branches of botany already mentioned. The great variety of subjects suggested by him to his students for their doctor's theses indicates the comprehensiveness of his interests.

A trained chemist and having studied for a time at Copenhagen, he took an active interest in fermentation, and he made valuable contributions to this chemical side of mycology. He was also largely responsible for the establishment of a school of pharmacy at the University of Geneva.

His great gifts as a teacher made him a first-rate popular lecturer, and his 'Biologie des Plantes' shows his great capacity to interest older audiences in those aspects of Nature which specially appealed to him.

In 1915 when the University of Geneva took over the alpine garden founded by Correvon at Bourg St. Pierre, Chodat established an alpine laboratory, La Linnæa, and there he gathered together every summer a number of his students and others from many parts of the world, not only

initiating them into the peculiar conditions of the alpine flora, but helping them to undertake researches into many aspects of alpine plants, the results of which were communicated to the Botanical Society of Geneva. Some of his work at Bourg St. Pierre was directed to the elucidation of the problem of the Mediterranean elements of the Swiss Flora. Contrary to the views of Dr. Christ, he was of the opinion that most of the many Mediterranean types found in the Valais had not made their way by the lower Rhone Valley and the Lake of Geneva, but across various passes directly from the south side of the Alps. His views on this subject are ably set forth in his 'Remarques de Géographie botanique' (Bull. de la Soc. Bot. de France, 1894), and further elaborated in conjunction with R. Pampanini in 'Le Globe', the organ of the Geographical Society of Geneva in 1902.

Chodat's eminence as a botanist was very generally recognised. He was appointed president of the First International Congress of Botanists when it met at Geneva in 1901, and was a honorary member of a large number of learned societies. He was awarded honorary degrees by the Universities of Manchester and Cambridge. His affection for England and for British Botanists was shown by his frequent visits to this country, where he had many close friends. He leaves behind him the memory of a vigorous personality with a charming disposition, a hard worker, and a worthy successor in Geneva to de Saussure and the de Candolles.

F. E. WEISS.

HERMANN CHRIST (1833-1933).—Dr. Hermann Christ, the famous plant geographer and specialist in the taxonomy of Abietineae, Carices, Roses, and Ferns, who, nearly a hundred years old, died on 23 November 1933, was not a professional botanist. Born at Basle, Switzerland, on 12 December 1833, he became a lawyer like his father and many of his ancestors. Hermann Christ prepared himself for this career at the Universities of Basle and of Berlin. It was in the latter city that he became a student of the famous botanist Alexander Braun, a student of a quite peculiar kind (1853-4), for he neither had lectures nor practical courses with Braun but only accompanied him on his excursions. It was on these that Christ became a friend of Paul Ascherson. In this highly scientific atmosphere Christ received a great many botanical impulses, though these had not been the first ones. Already as a school-boy of thirteen years by his father's advice he had begun to collect the plants of the surroundings of his native town. He had done it in such a scientific manner that, after a first publication on a hybrid of *Carduus*, issued in 1853-4, he was able to write the plant-geography of the

surroundings of Basle (1854-5)—an excellent little work, the ideas of which are still considered to be right. In this work Christ was especially influenced by Alexander Humboldt's splendid work 'Die Ansichten der Natur'.

When in spring 1856 he had finished his academic studies, he passed the summer months at Lausanne, wishing to improve his knowledge of the French language as well as to study the laws of a romance country. He realised these aims in such a complete manner that he acquired a perfect knowledge of the French language, which he afterwards spoke and wrote accurately, and that the following year he successfully passed the very difficult examination as a notary. But far more important, at least for Christ as a botanist, became the excursion he made from Lausanne to the lower part of the Valais, especially to Martigny and its surroundings. There for the first time he saw a flora of a dry country with a pronounced steppe character, as he had found it described in Humboldt's work. The result of this memorable excursion was his publication 'Pflanzengeographische Notizen über Wallis' (1857). This excursion, in some respect, had a decisive influence on Christ, as the botanical problems of this part of Switzerland played an important rôle in his work on plant-geography as well as on taxonomy. In his 'Souvenirs' (1917) he himself characterised this fact in the following words: 'Durant le semestre d'été je gagnais botaniquement, ce que je perdais juridiquement'. However, these losses cannot have been very heavy, as the success of his last examination in 1857 proved.

In 1859 Christ became a recorder in a court of justice, an appointment which enabled him to marry (1861). During these years Christ began his first studies in taxonomy, namely that of the Abietineae, the results of which he published in 1863. In 1868 he left his place at court and began his activities as a barrister. In this capacity he did not confine himself to private cases but extended his activities especially to questions concerning the rights of the railway companies. As a result he became the official adviser of the state-railways of the grand-duchy of Baden, and after the war of 1870-1 he accepted the same office for the Alsatian Railways, a function which, at the present time, would hardly be conferred upon a subject of a foreign country!

This very intense professional activity did not prevent Christ's botanical studies, which, at this period, concerned the plant-geography of Switzerland. Since his first excursion to the Valais he had visited all types of vegetation which are developed in his country, especially its alpine regions. Thus he was able to compare the distribution of the alpine plants in the Alps with that in other eurasian mountains

as well as in the arctic region. In his work 'Ueber die Verbreitung der Pflanzen der alpinen Region der europäischen Alpenkette' (1867) he was able to show where the different species grow most abundantly and from which centres they migrated into other countries. It was by this statistical method that Christ, besides the more climatic and edaphic points of view of his first works, treated the history of the alpine flora.

During all these years, as well as in the following ones, he continued to study the flora also of the lower regions of Switzerland. So in 1879 he 'tried', as he said, to give a general account of the plant-life of Switzerland ('Das Pflanzenleben der Schweiz'). In this volume containing several maps of plant-distribution he treated the floras of the different parts of his country with respect to the climatic and edaphic conditions, as well as dealing with the origin of the different species. This 'trial', we may say, was a complete success, a fact which was not only proved by the necessity to issue a second edition a short time after, and by its translation into French, but also because this book marks the starting-point of the intensive studies in plant-geography not only in Switzerland but in Central Europe as a whole. With this classical work, which has not lost its value to-day, Christ placed himself in the first rank of plant-geographers. In consideration of his valuable work the University of Basle awarded him the degree of Doctor Philosophiae honoris causa.

Some years afterwards (1885) Christ performed the first and only voyage of his life, considered in those days to be very extensive. He visited the Canary Islands, induced by Humboldt's magnificent description of the different zones of vegetation of the isle of Teneriffe and its Pic. The results of Christ's botanical observations made on these islands are contained in several voluminous publications.

Besides his studies in plant-geography he continued to treat taxonomic questions. In this respect he had a pronounced predilection for especially difficult genera. Thus in 1873 he published the results of his researches on the 'Roses of Switzerland', a very important book for rosology as a whole. His love of this genus lasted until the end of his long life, his last publication 'Les rosiers du Valais IV' being issued in his hundredth year (1933).

From 1885 to 1909 he also contributed to the taxonomy of the genus *Carex*.

In 1890, that is to say, when he was 57 years old, he began to study the Ferns, in some way as a successor of Sir W. J. Hooker and of J. G. Baker who had retired some years previously. As Christ was then the only botanist who occupied himself with this group in an intensive manner, he received

material from all parts of the World. Thus as he says in his 'Erinnerungen' (1923) he began a 'labor improbus' which lasted for twenty-three years (the last paper on Ferns being published in 1913) and during which he published 144 papers concerning this group exclusively. Amongst them we find three voluminous books, namely: 'Die Farnkräuter der Erde' (1897, 388 pages), 'Die Farnkräuter der Schweiz' (1900, 189 pages), and 'Die Geographie der Farne' (1910, 358 pages), each of which may be called a standard work.

This rich production would not have been possible even to Dr. Christ, if he had not retired from his activity as a barrister (about 1895). But he remained a judge of the high court of justice as well as a very active member of the committee of the Basle Protestant Mission. It was in this latter capacity that he heard about the cruelties committed against the natives of the Congo State. With his friend R. Claparède of Geneva, he founded the 'Swiss league for the protection of the natives of the Congo-State' (1908). He had the satisfaction of knowing that finally his efforts had some, though not the whole, of the success he had wished for. In the year of the foundation of this league Dr. Christ, aged then already 75 years, had the heavy grief of losing his wife, with whom he had been happily married for forty-seven years. This loss depressed him to such a degree that in the following years he gave away his library as well as his precious herbarium. In his depressed attitude of mind he was particularly cheered and pleased when the Linnean Society of London elected him a Foreign Member (1912).

Not being able to continue his researches on the ferns without an herbarium, Dr. Christ began to study the history of Botany. He was especially interested in the botanists of the sixteenth and seventeenth centuries, namely in Clusius, Boccone, Bauhinus, Dalechamps, and so on. His last masterpiece was his 'Geschichte des alten Bauerngartens' (1916 (1st ed.) and 1923 (2nd ed.), in which he traced in a charming manner the origins of the plants cultivated in the gardens of the farmers in the neighbourhood of his native town. The very last publications concerned the plant-geography and the roses of the Valais. Thus at the end of his long life he returned to that part of Switzerland, the flora of which had fascinated him at the beginning of his botanical career. His first publication having been issued in 1853-4, and the last one in 1932-3, he had published during 80 years. It is unlikely any other scientist or author before him has completed such a long period of activity as Dr. Christ did.

His high intelligence and infallible memory remained fresh and unaltered till his 99th year. Thus it was always

a pleasure to visit him and to hear his advice, which was not at all old-fashioned either on botanical or on general subjects. He really remained young in his mind and always received his visitors with a charming kindness. There is no doubt that these qualities were the result of his strong Christian faith which had been for him a perceptible reality all his life and which highly impressed everybody who had to do with him.

Christ's bodily health also remained quite good. It was only in the middle of June 1933, that is to say in the middle of his hundredth year, that some slight troubles arose and that his memory began to diminish. But his family as well as his friends had good hopes that Dr. Christ would complete his hundredth year. Unfortunately on November 4 he fell in his room and broke the head of a femur. So he had to remain in bed. From this very moment his forces diminished rapidly and so he quietly expired in his sleep on 23 November, nineteen days before his centenary. A great botanist and a really good man has passed away. G. SENN.

Complete lists of Dr. Christ's botanical writings have been published in: (1) 'Verhandlungen der Naturforschenden Gesellschaft in Basel', 1923, vol. xxxv, I. Teil, pp. 7-18, and a supplement in the same publication, 1934, vol. xlv, I. Teil, pp. ix-x, and (2) 'Berichte der Deutschen Botanischen Gesellschaft', 1933, Generalversammlungsheft von vol. li.

LILIAN J. CLARKE (1866-1934), who died in London on 12 February 1934, was born on 27 January 1866. She received her early education at Highbury High School, and showed early promise in science, being awarded the Botany Gold Medal of the Apothecaries' Society in 1885. Her later training took place at the Royal College of Science, Maria Grey Training College, and University College, where, after graduating in 1893, she was awarded a Gold Medal for Botany and a Research Scholarship.

Dr. Clarke's teaching career began at Battersea Polytechnic College, where she was Lecturer in Botany for some years. Later she was an examiner for the London University.

From 1896 to 1926 she was the Senior Science Mistress at the James Allen's Girls' School, Dulwich. There she was able by her determined efforts, supported by the Governors and successive Headmistresses, to do pioneer work in creating for the school a botany garden. There, in connection with laboratory work, experiments could be made on pollination, hybridisation, and plant physiology. She was able to see established before she died, a wood, a heath, bogs, sand-dunes, salt-marshes, beaches, ponds and fresh-water marshes, a lane, a cornfield and meadow for the study of ecology and

order beds for work in classification. Records of work kept for as long as twenty-nine years are used frequently for reference, as she encouraged her pupils to make their own observations and deductions on a broad basis without the aid of text-books. Among other experiments, those on water cultures are notable, plants having been grown in this way for long periods, such as peas for fourteen generations and aloes for seventeen years.

In 1917 the University of London conferred on her the Degree of Doctor of Science for a thesis on the work she had done at the James Allen's School.

Dr. Clarke became a Fellow of the Linnean Society in 1905, being one of the first women to receive this distinction.

For many years she was closely connected with the British Association: she went to S. Africa with the Association, and in 1921-6 acted as Secretary to the Education section. In 1933-4 she was Chairman of the Committee on the teaching of General Science in schools.

In planning the botany garden, her love of beauty was never sacrificed to enthusiasm for experimental work, as many past pupils and visitors from all over the world can testify and as the gardens themselves bear witness.

As a teacher her thoroughness and enthusiasm inspired many girls who are now distinguished scientists; her energy and vitality were such that she had an intimate knowledge of the results of present-day research and her senior pupils benefited in consequence. Her kindly help was ungrudgingly given to everyone with whom she came in contact.

E. FOGG.

REGINALD CORY (1871-1934).—By the death of Reginald Cory botanists and gardeners lose a warm friend. Born in 1871, the son of John Cory, the well-known South Wales coal-shipper, Reginald Cory was educated privately and at Trinity College, Cambridge, where incidentally he became an excellent oar.

Although a business career would naturally have been open to him, his inclinations never led him in that direction. He studied Law, but found that this career did not appeal to him. He, however, developed a fine taste in matters artistic, and a great interest in, and love of, plants, and his talents soon found a practical application. During his father's life-time as well as after his death, he did very much to extend and remodel the gardens at the family seat, Duffryn near Cardiff. The gardens at Duffryn had not the advantage of sloping ground, but they had a fine background of trees. Reginald Cory, however, took every advantage of what change of level could be found and designed a fine terrace backed by a great wall, running away from the house and bounding

one side of the garden. This piece of formal work was supplemented by several charming little formal gardens, each one differing from the other, showing the greatest possible taste as well as being conspicuous for the originality of their design. The effect of enclosure in such a garden obviously appealed to him, and he was lavish in the use of architectural stone or brickwork where it was necessary to carry out his ideas. Indeed, he was an excellent architect and draughtsman, and with this went, as is often the case, an aptitude for craftsmanship of more than one kind.

His gardening schemes, however formal they might be in design, had always as their basis the growing of plants. At Duffryn, he had a good climate but a difficult soil; but no plant came amiss to him. He amassed a wonderful collection of all kinds, hardy and tender. Bulbs and succulents under glass always appealed to him; out of doors, his favourites were perhaps shrubs and Dahlias. The formal gardens at Duffryn were, of course, only a comparatively small portion of the whole; the shrub borders which he laid out and planted were most extensive, and at one time the bed of a lake which had been drained was planted with thousands of Dahlias of a strain raised by himself. They were of striking colours which proved most decorative in a border, and were mainly single forms; but, though he gave of them generously to his friends, they were but little known to the general public.

A visit to the Arnold Arboretum in 1901 strengthened his interest in trees and shrubs, and he took very full advantage of the opportunities offered by the plant introductions of E. H. Wilson. In the Duffryn garden he had a very remarkable collection of Chinese trees and shrubs, a collection almost unrivalled in many genera, although owing to soil conditions inevitably not so complete in Rhododendrons.

His knowledge of plants was wide and profound, and his opinion on a question of identity was always well worth having. With his interest in plants came naturally an interest in botany and in horticultural books. Of the first he had a good working knowledge, of the latter he was a great collector. For very many years he gathered together the rarest and most sumptuous of horticultural and botanical publications. His collection was especially rich in works with fine coloured plates. It naturally overflowed the accommodation available both in his library at Duffryn and at his rooms in London, and not even the owner ever saw it fully and adequately displayed. Among his other interests was the study of birds and butterflies, and the collecting of Chinese Porcelain (chiefly of the Kien Lung period) and of other Oriental works of art. Music also played a great part in his life, and he spent much time at the organ and piano.

Reginald Cory with all his talents was one of the most gentle and modest of men, and he had the strongest distaste for any form of self-assertion or publicity. He was never willing, for example, even to take the Chair at a meeting or of a committee, however well fitted he was by knowledge or experience for that position, his Presidency of the Dahlia Society being perhaps the only exception that he made to this rule.

He was slow in making up his mind, but when once it was made up he did not readily change his opinion or his course. He had pronounced religious views, and was especially critical of ritual, and he was a most strong supporter of the Temperance movement.

But perhaps one of the most outstanding features of his character was his generosity, whether to a cause or to an individual. His generosity to individuals, where it was financial, was of course in most cases only realised after his death; generosity to causes was as unostentatious as he could make it. He was a most liberal benefactor, for example, to the Cambridge Botanic Gardens. He showed his desire to benefit horticulture by sharing the expense of several years' collecting in China by George Forrest, though in two of those years he took only the *Rhododendron* seeds, and these entirely for the purpose of presenting them to the Botanic Gardens and to his friends.

During the War he gave very generously to many appeals, and though not accepted for active service, he did most useful work in fitting out and manning his own ambulances, and also in connection with his own group of the Old Boys Corps in London.

Reginald Cory was elected a Fellow of the Linnean Society in 1922; he served on the Council from 1926 until 1928, and in 1928 and 1929 he was a member of the Audit Committee. He was a most useful member of the Library Committee from 1926 until his death, and was a welcome figure at all the gatherings of the Society. It is now known that the Society's new Presidential Chair, bearing the arms of the Society was a generous gift by him.

His work in connection with the Royal Horticultural Society was another great thing in his life, and a great thing for the Society. He was a member, and a very active member, of the Council from 1922-4, and again from 1929-30. He was also a member of many of the committees. On Floral Committee B his knowledge of plants and good judgment had full range and scope. On the Library Committee his knowledge of books made him an unquestioned authority; on the Wisley Advisory Committee, his knowledge of landscape gardening was often called upon.

But perhaps the committee in the work of which he took the greatest interest of all was the 'Botanical Magazine' Committee. A keen supporter of this publication, he was one of those whose generosity made it possible to put the work in the hands of the Royal Horticultural Society. He further made himself responsible for the production of one volume in the series with the object of making it an outstanding one. His work permanently in chronicling the achievements of the great 1912 International Horticultural Exhibition should not be forgotten—for, with the assistance of Mr. R. Hooper Pearson, he produced the 'Horticultural Record,' a large volume dealing with the Exhibition.

Of late years he had been a great traveller; he undertook a long collecting tour in South Africa in 1927, in the course of which he took special steps to have gathered together a collection of succulents and other plants for the Royal Botanic Garden, Edinburgh. He went to the West Indies in 1931; to the Atlas Mountains in 1932; and brought back botanical loot from every journey.

His happy marriage to Miss Kester in 1930 set him looking for a house in the Southern Counties; the search was a somewhat lengthy one, for he was fastidious in his choice, but he eventually purchased a house near Wareham, and was very busy with the formation of his garden and the establishment of his library, when most suddenly on May 12th of this year, the end came in the midst of his activities.

Great though Reginald Cory's work was for both botany and horticulture, what will last longest in the memories of those who knew him will be his personality; he was the most delightful of companions, courteous and unselfish, always in the highest spirits, most interestingly informed on a great number of subjects; and the very best and most loyal of friends.

ABERCONWAY.

WILLIAM GRANT CRAIB (1882-1933), who died at Kew on 1 September 1933, at the early age of 51, will always be remembered by his important contributions to the study of the Siamese flora, on which he had become the chief authority. Craib was born at Kirkside, Banffshire, on 10 March, 1882, and, after attending the Banff and Fordyce Academies, eventually proceeded to the University of Aberdeen, where he took the degree of M.A. in 1907. He was appointed Acting Curator of the Calcutta Herbarium in 1908, and in this capacity made collections in the North Cachar Hills. During the period from 1909 to 1915, Craib was Assistant for India at the Kew Herbarium, where he acquired a sound working knowledge of the Indian and Chinese floras, paying special attention to Leguminosae and the genus *Primula*. From 1909 onwards he became interested in the flora of Siam,

working out the magnificent collections made by Dr. A. F. G. Kerr, which now amount to over 21,000 numbers. The results were embodied in a long series of papers entitled 'Contributions to the Flora of Siam' and 'Additamenta', published in the Kew Bulletin from 1911 onwards. Under the conditions of his appointment at Kew, however, Craib was obliged to devote the major part of his time to Indian botany, and was unable to pursue the study of the Siamese flora as energetically as he would have liked. His appointment in 1915 as Lecturer in Forest Botany and Indian Trees at the University of Edinburgh enabled him to accomplish a great amount of research on Siamese botany during his vacations. An important series of three papers on the 'Regional Spread of Moisture in the Wood of Trees' appeared during the years 1919-23.

In 1920 Craib was appointed Regius Professor of Botany at Aberdeen in succession to the late Prof. J. W. H. Trail. There he made a special feature of Systematic Botany, and trained a band of competent systematists, who worked on the Siamese flora under his general direction. His '*Florae Siamensis Enumeratio*', now in its second volume, is being continued under the editorship of Dr. Kerr.

Craib was a keen field botanist, and had published a Flora of Banffshire in 1912, but the loss of a leg in a railway accident in 1921 greatly restricted his activities. Nevertheless, he was always cheerful, and, in spite of his grave disability, accomplished a remarkable amount of research during his last twelve years.

T. A. SPRAGUE.

LOUIS-LEOPOLD BAYNARD DE BEAUMONT (1849-1934) became a Fellow of the Linnean Society in 1885. He was educated in Paris, and was known as a fine classical scholar before he qualified in medicine at both Paris and London. He then specialised in science, which in those days was almost a single subject, but his main interest was in biology, to which he had the peculiarly French philosophical attitude throughout life. In this he resembled the late Professor James Ward, with whom he held discourse for many years. Like him he seldom wrote on biology, but he had a deep knowledge of every side of metaphysics in a search for the principles underlying life. In the latter half of last century we recall many such people who corresponded with one another, devouring and tabulating every new fact which came before them. They were convinced that they would one day attain to the truth, but, alas! its demonstration still eludes them.

Except for a life of Swedenborg and occasional philosophical notes, Mr. de Beaumont's writings were almost entirely confined to conchology, in which at one time he had large collections. He liked to talk with some amusement of the

discussions held in Parisian circles of the variation in his shells and the difficulties of their classification sixty years ago, when the attitude of systematists was still almost Cuvierian. Of the Linnean Society he often spoke, strongly approving of the unity of biology for which it stands—but, alas! lamenting the loss of that underlying classical flavour and simplicity that made the reading of his younger days both easier and more agreeable.

He died at Cambridge on 6 April 1934. J. S. GARDINER.

ERIC (FREDERIC) DRABBLE (1877-1933) was born at Herne House, near Chesterfield, in 1877, and died on 3 August 1933 at his home at Freshwater, Isle of Wight. He was educated at Chesterfield Grammar School, whence he proceeded to University College, Sheffield, and commenced a distinguished academic career. He passed in 1899 to the Royal College of Science, London, as a National Scholar in biology, and obtained the Honours Associateship of the College in botany. He became Doctor of Science (London) in 1903, and was awarded the corresponding degree of Sheffield University five years later. He was elected Fellow of the Linnean Society in 1902.

Drabble's professional work was as a teacher and examiner. In 1901 he succeeded A. W. Bennett as lecturer in botany at St. Thomas's Hospital Medical School and from 1903-5 worked under Farmer at the Royal College of Science as lecturer and senior demonstrator. His next move was to take up the newly-created lectureship in economic botany at Liverpool University, but the applied side of the science had no real attractions for him and he returned to London in 1906 as head of the botanical department of the Northern Polytechnic. Here he worked happily and with great success until 1924, when ill-health—a life-long handicap—compelled him to retire from active teaching. During the War, when he was rejected as unfit for service, he released others by taking over the botanical classes at Birkbeck College. He was an able and much appreciated teacher.

Drabble's main interest was in phylogenetic relationships, on which he was maturing his ideas. His published work, however, centred around anatomy, cell physiology, and British botany. His chief paper, 'On the Anatomy of the Roots of Palms', was published in the Transactions of the Linnean Society (ser. 2, 1904) during the height of the study of stelar theories in which he was much interested, and formed his thesis for the London doctorate. His physiological papers, written in association with his wife and, among others, Dr. Nierenstein, appeared in the 'Proceedings

of the Royal Society', the 'Biochemical Journal', and the 'New Phytologist' between 1905 and 1908.

The work for which Drabble will be chiefly remembered is his series of taxonomic studies of the British flora. There is no question of Drabble's critical powers in this field, and his death at a time when his maturing experience was fructifying in a succession of papers is a matter of the greatest personal and scientific regret. He had planned a number of investigations of difficult groups. Here the most notable achievement was his classification of the British Pansies, which was published in 1929 ('Journal of Botany'), followed by supplementary studies of the *Arvensis*, *Tricolor*, *Saxatilis*, *Nana*, and *Lutea-Curtisii* series (1926-8), which enabled his 'Key to the British Pansies' to appear in 1929 (Journ. Bot.). Concurrently, and later, he published notes on the Irish, Scottish, and Derbyshire pansies, and on the general distribution of the plants in England and Wales. This work rendered him the unquestioned authority on the group. Enquiries of a similar character included 'The British Veronicas of the *Agrestis* Group' (with J. E. Little, in Journ. Bot. 1931), 'British Forms of *Ranunculus acer* L.' (Bot. Exch. Club Rept. 1931), '*Ranunculus bulbosus* L. and its Varieties in Great Britain' (Bot. Exch. Club Rept. 1932), '*Valeriana officinalis* L. and its Allies in Great Britain' (Journ. Bot. 1932), and 'The Genus *Crepis* in Great Britain' (Journ. Bot. 1932-3). In 1909, 1916, and 1917 there appeared notes on the 'Flora of Derbyshire', written in association with his wife; and his sojourn in the Isle of Wight produced a list of plants from the Island (with J. W. Long in Bot. Exch. Club Rep. 1931).

Drabble was remarkable for his varied interests. He was a competent zoologist ('Notes on the Diptera of Derbyshire', in joint authorship with his wife, was published in the 'Entomologist', 1916, 1918), a lover of music and literature, and, an ardent Anglo-Catholic, a student of theology and church history. His various activities brought him into touch with many people, and few who knew him could deny his generous sympathy and capacity for lasting friendship.

Drabble married Hilda Lake, one of his students, in 1906, and she survives him. He ever acknowledged the great debt he owed to the care, guidance, and assistance he received from her.

S. E. CHANDLER.

FRANCIS GAYNER, M.A., M.B., B.C., M.R.C.S., L.R.C.P., F.L.S.—The sudden and unexpected death of Francis Gayner on 23 November 1933 came as a great shock to his many friends, and the Society has lost a keen supporter. His botanical interests lay principally with alpine plants, of which

he was a very successful cultivator. Most of his plants were of his own collecting, and the writer retains the pleasantest memories of a holiday with him some three years ago on Monte Baldo and around Lake Garda, when he added several treasures to his collections.

Gayner was born in Co. Durham in 1870, and received his early education at the Friends' School, Scarborough. He then entered his father's shipping office for some years, but finding the work uncongenial he went up to Cambridge and became a member of King's College, where, though he was then 25, he entered fully into the life of the College, and was beloved by all of us who learnt to know him and appreciate his sterling character. He studied biology and gained a First Class in the Natural Sciences Tripos in 1898. After taking his degree he travelled in Ceylon and the Far East and made a large collection of Lepidoptera. In addition to extensive journeys on the continent, he also visited Egypt and the Sudan. Among his intimate friends was the late A. F. R. Wollaston with whom he travelled in Scandinavia, fully sharing his tastes and interests.

On his return from his travels he decided to take up the study of medicine—a fitting branch of science for one so full of human sympathy and kindness of heart—and after studying at the London Hospital and at Addenbroke's Hospital, Cambridge, he started to practice as a Physician at Redhill at the age of 36. There he made his home, a home much to be envied with its genial, kindly host full of wit and humour, who, with his wife, diffused happiness both to the whole and more especially to the sick. His love of the beautiful was reflected in his life, and his cheerful kindness, courtesy, and true sympathy did more perhaps to restore health and happiness where it was most needed than any medical prescriptions.

Francis Gayner was indeed 'The Beloved Physician', and there are very many who will so think of him in pious memory.

ARTHUR W. HILL.

HENRY GEORGE GREENISH (1855-1933).—A long life of devotion to British Pharmacy as teacher and investigator was closed by the unexpected death of Professor Greenish on August 2nd, 1933. He died a few days after his retirement and when he was looking forward to a period of relief from strenuous work after forty years in the service of the Pharmaceutical Society.

Henry Greenish was born in 1855, the son of Thomas Greenish, with whom he served his apprenticeship and who was successively Treasurer (1878-80) and President (1880-2) of the Pharmaceutical Society, and, in 1886, President of the

British Pharmaceutical Conference. After matriculation from the old Philological School in Marylebone, Greenish became a student in the Pharmaceutical Society's School (1873-7) and in 1875 was Bell Scholar. Following his Major Examination in 1877 he studied for two years at Dorpat under Prof. Dragendorff, the eminent pharmacognosist, and subsequently at the University of Vienna.

In 1890 he started his long career as a teacher in the Pharmaceutical Society's School, being successively lecturer in *Materia Medica*, Professor of Pharmaceutics, and Dean of the School. He was also Professor of Pharmaceutics in London University.

Prof. Greenish took an active part in the revisions of the British Pharmacopeia and of the British Pharmaceutical Codex. His published works include a text-book of *Materia Medica*, which is widely used by students and pharmacists, and a long list of memoirs of original investigations on various drugs. His work in the field of pharmaceutics was recognised by the award of the Hanbury Medal in 1917, and by his selection by the Professorial Board of L'Ecole de Pharmacie de Paris for an honorary doctorate in the University of Paris in 1919. In 1921-2 he was President of the British Pharmaceutical Conference. He joined our own Society in 1884, and was also a Fellow of the Institute of Chemistry, a Corresponding Member of the Société de Pharmacie de Paris, and of a number of other Continental Societies, and an Honorary Member of the Philadelphia College of Pharmacy.

He did good service during the war in the development of the cultivation of medicinal plants in this country and in the investigation of problems submitted by the Government to the Pharmaceutical Society.

I made his acquaintance in my early days at the British Museum, when he was introduced to the Department of Botany by the late E. M. Holmes. The association was, I think, of mutual benefit; he was always ready to advise on occasions when his special knowledge was helpful.

Of Greenish's life among his students at Bloomsbury Square I have no intimate knowledge, but I am asking my old pupil, Mr. T. E. Wallis, who has been his assistant in the school for a number of years, to add a few lines.

A. B. RENDLE.

The teaching of pharmacy and of pharmacognosy in this country as departments of serious scientific study owes almost everything to the initiative of Professor Greenish, who first organised carefully planned courses of instruction in both subjects. He was also instrumental in establishing

research laboratories for pharmacy and for pharmacognosy, in addition to the laboratory already existing in the Pharmaceutical Society's building for research in chemistry. As a teacher, he possessed the gift of presenting the subject-matter of his lectures with a wealth of interesting experiments illustrating fundamental principles, and he also made free use of lantern-slides to depict large-scale operations, to explain the construction of complicated machinery, and to show the details of the cultivation and collection of many important crude drugs. Professor Greenish encouraged the social and athletic activities of the students by attending dances &c. and visiting the sports grounds. He was an inspiration to all around him, and succeeded also in establishing contact with the pharmaceutical departments of Continental universities and as recently as Easter 1928 he conducted a party of students on a visit to Holland to see something of the teaching and practice of pharmacy in that country. He was a good linguist, and by his genial manner made many friends both in this country, on the continent of Europe, and in America.

T. E. WALLIS.

By the death of CHARLES CARMICHAEL LACAITA on 17 July 1933, the Society has lost a Fellow of that rare type which combines the highest standard of culture with an innate love of nature. He was born at Edinburgh on 5 April 1853, his father being Sir James Lacaita, K.C.M.G., an Italian who was interested in politics and a personal friend of Gladstone, and his mother a daughter of Sir Thomas Gibson Carmichael. At the age of fourteen he was sent to Eton, where he distinguished himself both in school work and at games, and he proceeded thence in 1872 to Balliol College, Oxford. Here he developed marked literary interests, and became, not only a good classical scholar, but well versed in Italian, French, and Spanish. He also spoke German and modern Greek. The father, Sir James Lacaita, possessed an Italian estate at Leucaspide (Taranto), which his son visited annually for several years after leaving Oxford, and these journeys aroused his interest in botany and the Italian flora. During this period he also travelled in Spain, the Pyrenees, the Maritime Alps, Switzerland, and Greece, and made collections of plants that brought him into contact with Continental botanists of repute.

In 1879 he was called to the Bar, and in 1885 was elected M.P. for Dundee and became Assistant Private Secretary to Lord Granville, then Secretary of State for Foreign Affairs in Gladstone's Ministry. He was again returned to Parliament in the election of 1886, but in the following year he retired and took no further part in active political life.

Meanwhile he had married in 1885, and in the succeeding years he was largely occupied with the building of his house at Selham and the development of its fine garden. As might be expected, he soon found manifold interests in the county of Sussex. About this date he began to write on botany, and an article from his pen, 'On the Etymology of the Words *Crocus* and *Saffron*', was printed as an appendix to Maw's 'Monograph of the Genus *Crocus*' (1886). In 1895, on the death of his father, he inherited the estate of Leucaspide, and subsequently, from an aunt, a second Italian property near Ravello. These legacies involved periodical visits to Italy, and early in the present century Lacaita's interest in the botany of that country assumed fresh vigour. He began to study intensively a number of critical genera, on which a series of notes, 'Piante Italiane critiche o rare', extending over the period 1910-27, were published in the 'Nuovo Giornale Botanico Italiano' (Bull. Soc. Bot. Ital.). In 1913 he visited India, and an account of his botanical gatherings was published as 'Plants collected in Sikkim' in Journ. Linn. Soc., Bot. xliii, 457 (1916). In his later years he turned his attention to the flora of Spain, where he made five further botanical excursions in 1923, 1925, 1926, 1927, and 1928. Two papers in 'Cavanillesia' (1928 and 1930), 'Novitiae quaedam et notabilia hispanica', resulted from these expeditions. In 1924 his wife died, and he married a second time in 1929. Throughout his life he was a devotee of tennis, which he continued to play until incapacitated by a motor accident in 1931—a somewhat remarkable record.

In addition to his articles in Continental publications Lacaita produced some valuable critical papers in this Society's Journal (on *Echium*, xlv, 364 (1919); xlvii, 175 (1925): on *Onosma*, xlvi, 387 (1924); and on *Marrubium*, *Ballota*, and *Colchicum montanum*, xlvii, 155 (1925)), and numerous notes, often of interest to British botanists, in the 'Journal of Botany'. Boragineae (especially *Onosma*, *Echium*, and *Pulmonaria*), Compositae and Labiatae seem to have been his favourite families. As a taxonomic botanist he possessed a rare combination of qualifications. His linguistic abilities placed most European literature at his ready disposal; his keenness and energy in the field were unflagging; and he realised the importance of bringing critical forms to the test of cultivation. The species of some genera, such as *Pulmonaria*, he grew extensively at Selham. His wide knowledge, coupled with his alert and logical mind, gave great weight to his opinions on questions of taxonomy; and the soundness of his views and the fairness with which he would weigh evidence in argument rendered discussions with him a privilege to be appreciated.

He joined this Society in 1882, and was a member of the Council from 1918 to 1922 and Vice-President for 1921-2. He had also been a member of the Società Botanica Italiana from 1902. His herbarium has been bequeathed to the British Museum (Natural History), and his fine collection of botanical books was recently sold at Sotheby's.

He was buried on 20 July 1933 at Selham, leaving a widow and a daughter, the wife of Lieut.-Col. G. Windsor-Clive, M.P. His only son, Capt. F. C. Lacaita, M.C., was killed in the Great War. An excellent portrait accompanies the notice by Prof. R. Pampanini in 'Nuovo Giornale Botanico Italiano', n. s., vol. xl, n. 3 (1933).
H. W. PUGSLEY.

By the sudden death of CLIVE ERROL LORD, F.L.S., at Hobart, on 15 July 1933, at the comparatively early age of forty-three years, there was lost to Tasmania one of the most active of its rising young scientists. Mr. Clive Lord came of a distinguished family, closely associated with the history and development of Tasmania since its foundation. He himself kept up the proud tradition, since at his death he was not only Director of the Tasmanian Museum but was Secretary of all the important scientific bodies, such as the Royal Society of Tasmania, the National Park Board, the Tasmanian Field Naturalists' Club, the Advisory Board on the Export of Fauna, and the local Committee of the Australian Association for the Advancement of Science. He was also a member of the Sea Fisheries' Board and of the Animals' and Birds' Protection Board.

Lord's early interests lay in the direction of ornithology, and he soon became a recognised authority on Tasmanian birds, as regards both habits and species. On his appointment to the Directorship of the Tasmanian Museum, his interests began to widen. He worked in close collaboration with Mr. H. H. Scott of the Victoria Museum, Launceston, the result being the publication of a series of papers on Tasmanian mammals, living and fossil. This collaboration culminated in the production of a volume, more or less popular, in which an effort was made to give a short critical description of all Tasmanian vertebrates with a brief account of the habits of each (Lord and Scott, 'A Synopsis of the Vertebrate Animals of Tasmania': Hobart, 1924).

More recently Lord had begun to interest himself in the history of early Tasmanian exploration—a most prolific field of investigation,—and it was due to his initiative that the Royal Society of Tasmania, with the help of the Tasmanian Government, began a scheme to suitably mark and commemorate localities of interest in the history and exploration of the island.

All his life Lord had been an ardent yachtsman, and the present writer has pleasant and vivid recollections of happy days spent some years ago in his company and that of other kindred spirits on numerous trips, with the object of investigating the natural history of the many beautiful bays of the Derwent Estuary.

Clive Lord will be sadly missed by his many friends and co-workers.

He was elected a Fellow of the Linnean Society of London on 2 March 1922.

T. THOMSON FLYNN.

MALTE OSKAR MALTE (1880-1933), born at Ostra Hoby, Kristianstad's län, Sweden, received his botanical training at the University of Lund where he obtained his Ph.D. Records of his Swedish career are very sparse, but some time was spent by him at the plant-breeding station at Svalof. My first acquaintance with him dates from his arrival in Canada about the year 1910, when he was attached to the Seed Branch of the Federal Department of Agriculture for 'discipline and pay'. During this period he spent much of his time in association with James M. Macoun, of the Geological Survey, working over the vast collections made by the late John Macoun. He became keenly interested in Canadian plants and did extensive travelling, until in 1912 the Central Experimental Farm at Ottawa offered him the post of Dominion Agrostologist, which he filled with every success until his warm wish and ambition became realized, and he received the appointment of Chief Botanist to the Geological Survey (Division of Biology) of Canada—a worthy successor to the Macouns, father and son, who for many decades were associated as naturalists and collectors with this old-established organization. The position, alas!—at least its development,—was somewhat disappointing to this energetic, kindly, and good-natured botanist. In this vast Dominion of ours Botany is veritably the stepchild, and whatever his keen ambition was to develop at last a thoroughly competent service or botanical survey, he played the part of the lone wolf until his untimely early death. There was no one, except one or two mounters, to assist him with a territory to cover, which, after all, was intensely virgin as far as critical botany was concerned. Many times over our pipes we would discuss this regrettable lack of interest on the part of a number of cautious governments, and, although never daunted, always of happy, cheerful, generous disposition, he keenly felt the hopelessness of the situation. Eventually he failed in health, perchance through not taking sufficient care of himself—which might not have been so, had he not preferred to remain a bachelor.

He commenced his work at the Museum with a study of the local flora of Ottawa and district within a twenty-five-mile radius. His death cut short the final touches to this—perhaps the first—attempt under Government auspices of a local flora.

He travelled and collected extensively in east and west until in 1927 his greatest ambition to visit the Arctic region and to link up the flora of Scandinavia and Greenland with that of the northern zones of Canada became realized. He spent some months in the Yukon, Arctic Archipelago, Hudson Strait, Hudson Bay districts, and verily revelled in this interesting collecting-ground. This life did not improve his health, for care he would have none, and a year or two following he spent more quietly in Ottawa with short trips to the Eastern provinces. In 1930 we both travelled to Cambridge to take part in the International Botanical Congress. The days of leisure on the boat were most enjoyable, and the dreams we dreamt of what might be done in Canada, botanically speaking, alas! are likely to remain a friendly but far-off mirage. While in Europe—especially in Great Britain—he established wide contacts with botanists and went for some months to visit old haunts in Sweden. Finally, in 1933, much against the will of his friends, he joined once more the party of the good ship *Nascopic* on his way to Hudson's and James' Bay. 'I feel better than I ever did' were his parting words to me—alas! it was on his bier, which I could barely reach in time, that we parted for ever. I knew him, loved him—we all did—as 'Uncle Oskar'.

Fernald of Harvard told me when he looked over Malte's last collections that he was an extremely energetic and prolific collector. On his comparatively short collecting-trip in Alberta in 1925 he collected over 6000 sheets. In the Arctic in 1927 he collected about as many, drying them over the boilers of the engine room—the fiddley of the ship. He recorded numerous species never recorded before from Baffin Island. He was critical in his work as well as neat. All who had the privilege of knowing Oskar Malte grieve at his early death, but, wherever he went, he built for himself in the hearts of man a lasting glorious monument, because of his unfailing sincerity and ever-radiant smile.

H. T. Güssow.

ASHLEY HENRY MAUDE (1850-1933).—It was not until he had reached the age of thirty-five that Ashley Maude became a botanist: the interest had been latent, but the opportunities lacking. At thirty-five these came to him, and through the rest of his eighty-three years his great energy found a congenial outlet in efforts to know the vegetation of whatever locality

he might be in. As a permanent record he formed a herbarium of 5000 sheets.

He was the third son of Colonel Sir George Ashley Maude, R.A., for many years Crown Equerry to Queen Victoria. Educated at Wellington College, he became a clerk in the Board of Trade in 1868, and was called to the Bar. In 1876 he married. Until 1884 he spent a busy uninterrupted life in London; then his wife's health gave way, and for her sake he broke with it, removing to Coates, near Cirencester. It was characteristic of him that to fit himself the better for the country he should wish to study Agriculture and should attend classes at the Royal Agricultural College, Cirencester. In those classes his Botany began.

He removed from Coates to Newbury and farmed. There in 1889 his wife died. In 1890 he removed to Shakleford, near Godalming, and in 1898 to Eastbourne.

During the fifteen years in which he resided at the last-named place, he took an interest in local affairs: he contested and won a seat on the Municipal Council in 1899, was re-elected unopposed in 1902, and chosen to be Mayor in 1903-4. During his mayoralty the Caldecott Museum and the Public Library found a new home in the Technical Institute. He served as a J.P. from that date until 1914.

In 1908, during his Eastbourne life, he became a Fellow of the Linnean Society, but soon went to live so deep in the country that attendance at the Society's meetings was difficult. After the War he was in London again and then for a time a regular attendant who sometimes took part in the discussions. Age, however, soon began to demand concessions, and he spent longer periods abroad during the winters, yet maintaining a wonderful activity to the end, so that few who saw his upright figure, and particularly those who saw him in the saddle, would have guessed that he had passed his eightieth year.

His herbarium has been given to the British Museum. It consists of plants from Britain, France, the Alps, Algeria, the Canary Islands, and the Cape.

I. H. BURKILL.

THOMAS HAYTON MAWSON (1861-1933).—Following an illness that lasted for nearly eight years, Mr. Mawson passed away at Applegarth, Hest Bank, Lancaster, on November 14, 1933. He had a fascinating life experience, and during the later years came to be regarded as the foremost landscape gardener of his time. In his earlier years he was undecided in regard to his career, but, as beauty of form and colour appealed to him greatly, he entered the service of John Wills, who was then the foremost floral decorator in London, a man of strong character, a genius in his profession, and, as so frequently

happens in such cases, quaintly eccentric at times. How much John Wills influenced T. H. Mawson will never be known, but at least he learnt the art of arranging plants and flowers in the most artistic manner. Later, Mawson travelled widely in this and other countries, studying gardening and garden design. He studied to such purpose that, coupled with natural instinct in the direction of good taste and great personal ability, he soon became famous as a landscape architect and founded the firm now widely known as Messrs. T. H. Mawson & Son. Public parks at Wolverhampton, Southport, Southgate, Hanley, and Burslem are examples of his work at home, while the gardens at the Peace Palace at The Hague, and at Regina and Vancouver in the American Continent are also examples of his skill. Perhaps, however, his greatest achievement was the town-planning of Athens, a noble work for which the Government of Greece awarded him the Order of the Redeemer. At Northampton and at Salonika he also carried out town-planning schemes of considerable extent. Mawson was one of the founders, and a President, of the Town Planning Institute, a Fellow of the Linnean Society since 1921, first President of the National Institute of Landscape Architects, and a Liveryman of the Worshipful Company of Gardeners. An easy and attractive writer, he was author of 'The Art and Craft of Garden Making'—a work that was badly needed by students and one that ran into several editions; and of 'Civic Art: Studies in Town Planning, Parks, Boulevards, and Open Spaces'. Late in life he wrote and published 'The Life and Work of an English Landscape Artist'; this is the story of his life and work, and is a most fascinating volume, and one that all students of landscape art should read, as it tells of his determination to succeed—difficulties overcome and successes achieved.

C. H. CURTIS.

DUKINFIELD HENRY SCOTT (1854-1934).—Dr. Scott's death on 29 January, after a very short illness, removed from the list of our Fellows one who has been very closely associated with the work of our Society for 54 years. He acted for many years as Member of Council, from 1902-8 as Botanical Secretary, and from 1908-12 as President. Indeed, he identified himself in every way with our activities almost up to the time of his death, attending a meeting on 4 January and presiding at the Club dinner afterwards. The duties he undertook may often have been exacting, particularly after his retirement to Basingstoke, but he carried them out with the willing and cheerful spirit characteristic of him. Born in London in 1854, the son of the famous church-architect, Sir Gilbert



DR DUKINFIELD H. SCOTT, F. R. S.
President, 1908-1912.

(From a photograph by Lafayette taken in 1908.)

Scott, he was educated at home by tutors, taking up on the advice of his mother the study of botany, devoting much time to the microscopic investigation of Freshwater Algae and reading the English translations of the great German botanists of the time, Naegeli, von Mohl, and Hofmeister.

These early botanical studies were interrupted by a course for 'Greats' at Oxford followed by several years as an engineering student. It was not until 1880 that he took up botany again, deciding on the advice of Thiselton-Dyer to go to a German laboratory. Consulting Vines he chose Würzburg, where he worked under Sachs's stimulating direction, taking his Ph.D. in 1881 for a thesis on laticiferous vessels. Interesting reminiscences of his work in Sachs's laboratory and of university life in Würzburg will be found in the 'New Phytologist' of 1925.

On his return from Germany he was appointed assistant to Prof. Daniel Oliver at University College, and there I met him first, being one of the students attending the advanced course of lectures which he gave in 1884. Fresh from Sachs's laboratory and basing his course largely on Goebel's recently published 'Grundzüge der Systematik und speciellen Pflanzenmorphologie', the systematic portion of Sachs's Lehrbuch, it was a stimulating experience for his audience. Unfortunately this was my only course under Scott's tuition, for he was appointed in 1884 to South Kensington, where he acted as Assistant to Huxley, later taking full charge of the botanical teaching until he went to Kew as Honorary Keeper of the Jodrell Laboratory. There he was visited by Williamson, who had retired from Manchester in the same year, and in the Jodrell Laboratory began that fruitful collaboration between the venerable palaeobotanist and his more youthful disciple, whose enthusiasm for fossil plants he had kindled a few years before during a visit to Manchester.

Up to that time Scott had been engaged in the detailed investigation of the anatomy of plants such as the occurrence of 'internal phloem in the root and stem of Dicotyledons', the 'secondary tissues of certain Monocotyledons', and 'the anatomy and histogeny of *Strychnos*'. No doubt these papers attracted the attention of Williamson, for he had realised that he was out of touch with modern plant anatomy and was on the look out for a collaborator who had these qualifications. Thus their joint work was started, and after Williamson's death in 1895 Scott continued his palaeobotanical work and became the recognised leader in the investigation of the structure of fossil plants, particularly of the Coal Measures. Not only the vegetative organs but also their fructifications yielded up their secrets to him and helped him to interpret their relationships. In a masterly way he would muster

the various features of importance, both those of his own discovery and equally those of other workers, and thus present a complete picture of the structure of the various groups of fossil plants concluding with a general discussion of their interconnection and possible evolution. That is the plan of his 'Studies in Fossil Botany', the outcome of a special course of lectures given in the London University, the first edition appearing in 1900, the third edition in 1923. Each edition embodied further work of his own and of others. The epoch-making discovery by Oliver and Scott in 1904, that the seed known as *Lagenostoma* belonged to the fern-like *Lyginopteris*, had to be incorporated in the second edition, so that the book has not only grown in size but has remained up to date. A course of lectures delivered at Aberystwyth in 1923 on 'Extinct Plants and Problems of Evolution', and published under that title, remains to us as a later summary of Scott's general outlook on the evolution of the plants he had most closely studied. As he was a master craftsman he collected a number of disciples around him both by the stimulus of his teaching and by the generous help he was always ready to extend to them, both in the way of advice and of material. Thus directly and indirectly Palaeobotany owes many of its advances to him. Scott's collection of preparations of fossil plants numbering over 3000 were bought by the British Museum in 1923, and supplements the Williamson collection which Scott was instrumental in obtaining for the national museum. Scott's eminence has been widely recognized both at home and abroad. He was elected to the Royal Society in 1894 and was an honorary or corresponding member of numerous Academies and Scientific Societies on the Continent. He was awarded a Royal Medal in 1906 by the Royal Society and the Darwin Medal in 1926. The Geological Society awarded him the Wollaston Medal in 1928, and we gave him the Linnean Medal in 1925.

Scott married in 1887 Miss Klaassen, who had had a botanical training and was to him a constant helpmate in his scientific pursuits as well as in his hospitable home, both in the Old Palace at Richmond and later at East Oakley House. Her death in 1929 was a profound grief to him, and with his four daughters married and living at some distance he seemed latterly a somewhat solitary figure in his country home. Still, in company, he was always cheerful and maintained his interest in every aspect of botany, as he showed by taking an active part in the discussion of the various communications made to the meetings of the Linnean Society which he attended. The Fellows of the Society will cherish his memory, for he had made innumerable friends by his cordiality and his ever-ready sympathy in their botanical problems.

The portrait reproduced here (Plate 1) was taken in the same year as his election as President of the Society.

F. E. WEISS.

THE news of the death of Dr. O. STAPF which occurred on 4 August 1933, while he was on holiday in the Tyrol, came as a great shock to his friends and particularly to his colleagues at Kew, where he was held in great affection and respect.

Otto Stapf was the son of Joseph Stapf, and was born at Ischl, in Salzkammergut, on 23 March 1857. His father was Oberbergrat and had charge of the salt springs at Hallstadt. The son studied at the Vienna University under Julius Wiesner and became assistant to Kerner von Marilaun in 1882 and Privatdozent in 1887. In 1885 Stapf travelled in Persia and subsequently published several papers dealing with the botany of that country. His well-known monograph of the genus *Ephedra* was also one of the outcomes of this expedition. His interest in the flora of the Orient and of Persia particularly remained to the end. In 1890 he was offered and accepted the post of Assistant for India in the Kew Herbarium, succeeding W. B. Hemsley, and thus commenced his long association with Kew. In 1899 he was appointed Principal Assistant and during this period of his career his work was largely concerned with elaborating various families for the important Floras prepared at Kew, namely, the 'Flora Capensis' and the 'Flora of Tropical Africa'. These families included the Apocynaceae, the Orobanchaceae, the Lentibulariaceae, the Pedaliaceae, and the Gramineae. He was the authority on the Gramineae, and material of this important family flowed to Kew from all parts of the world.

On Hemsley's retirement, in 1908, Stapf was appointed Keeper of the Herbarium and Library, a post which he retained until he retired under the age limit in 1922. During this period he naturally had less time for research, but contributed many papers and revisions, notably on African and other Gramineae. A full account of Stapf's work with a select list of his publications will be found in the Kew Bulletin (1933, pp. 369-390). He was elected to the Fellowship of the Royal Society in 1908, and was a Corresponding Member of the Vienna Academy of Sciences, the German Horticultural Society, and an Honorary Member of the German Botanical Society.

On his retirement in 1922, Stapf undertook the Editorship of two important works, becoming Honorary Editor of the 'Index Londinensis' for the Royal Horticultural Society and Editor of the 'Botanical Magazine'. The former work was designed as a new edition of Pritzel's 'Iconum Botanicarum Index', and was issued as an emended and enlarged edition

including references to all plates, figures, and photographs of flowering plants and ferns published from 1753 to 1920. Stapf drew up the plan of compilation for this huge task and supervised it throughout, his extensive knowledge both of plants and of literature being invaluable, and his wide circle of acquaintances enabling him to secure the world-wide co-operation of botanists. The Index, which was completed in six large quarto volumes in 1929, serves practically as an index to taxonomic botanical literature, since from the illustrated papers references can be found to non-illustrated works.

But Stapf's chief interest after his retirement lay in the 'Botanical Magazine', which in 1922 became the property of the Royal Horticultural Society. Into this work he threw himself heart and soul. Only those who have been concerned with the production of this Magazine can conceive of the labour involved if the articles on the species (selected promiscuously from the whole range of families of flowering plants) are to be drawn up thoroughly and conscientiously. To Stapf each article implied a miniature monograph, for which he had to acquire a correct view of the whole genus. Revisions or partial revisions of genera were necessary at every turn. For these and other services to the R. H. S. he was awarded the Victoria Medal of Honour and the Veitch Memorial Medal.

Stapf attended the International Congresses at Vienna in 1905 and at Brussels in 1910 and also the British Association Meeting at Toronto in 1924. His services to the Linnean Society will be remembered by many. He was elected an Associate in 1898 and became a Fellow in 1902. He served on the Council and was appointed Botanical Secretary in 1908, which position he held till 1916. To this latter duty he devoted careful attention, as he did to all he undertook; he, moreover, engaged actively in the discussions, to which he made valuable contributions from his rich store of knowledge. He was Vice-President for the Session 1916-7 and was awarded the Linnean Gold Medal in 1927.

Stapf was devoted to his Science. He had an immense power of concentration, and, being a man of great ability and of wide reading, all his work was marked by thoroughness and scholarship. His knowledge of languages and his many friends abroad also contributed to his success as a botanist. His patience appeared inexhaustible. On numberless occasions has he been found very late in the Herbarium absorbed in the remote ramifications of a taxonomic problem and completely oblivious to time and his evening meal. As a teacher he was inspiring and set the highest standard of thoroughness and meticulous care. At times he appeared stern, but at heart he was kindness itself.

The War period was a most difficult one for him. Both personally and in his official capacity he had intimate friends on both sides, and, though loyal to the country of his adoption, he had a deep love for his native land. Being a strong believer in internationalism he felt the War and its results acutely, and did not hesitate to criticise the Central Powers. Later he became an enthusiastic supporter of the League of Nations Union.

The following extract from a letter received by Mrs. Stapf from a friend at Kew shows how Dr. Stapf was esteemed by those outside the circle of his scientific colleagues :—‘ How much your husband contributed to our happiness, and how much we enjoyed his society ! How full of knowledge and sympathy he was, how sweet in temper and disposition, how sane and dear in his judgment of his fellows and the world about him ! He seemed to face all kinds of questions so reasonably, and yet with so full a sympathy with and insight into their difficulties : and for a man with such wide knowledge as he possessed how modest the expression of his opinion always was ! He was indeed a very fine example of the right balance of reason and emotion, and his physical presence fitted so well with his qualities of mind and heart ’.

A. D. COTTON.

HARRY F. TAGG, who died in 1933 at Edinburgh in his sixtieth year, was one of our senior Fellows, having been elected to the Linnean Society in March 1899. For nearly forty years he was a member of the staff of the Edinburgh Royal Botanic Garden, and for a long period Assistant to the late Sir Isaac Bayley Balfour. It was in the Museum attached to the Garden, that his main interest lay in the early years of his service, and he spared no pains to promote its efficiency. With the University Department of Botany so closely connected with the Garden there was a special need for exhibits of an instructive kind and these Tagg set himself to provide. He developed a technique all his own and some of his dissections of flowers neatly labelled and permanently preserved are monuments of his skill and careful work. The record of Tagg’s work will be found scattered through the ‘ Transactions of the Botanical Society of Edinburgh ’. Tagg was an expert photographer. In later years he turned to the systematic side of Botany, concentrating upon the genus *Rhododendron*, and his wide knowledge of this interesting and difficult group of plants fitted him to an exceptional degree for collaboration in the preparation of a detailed review of the genus. This was published in 1930, under the title ‘ The Species of *Rhododendron* ’.

Tagg published numerous short papers mainly in the ‘ Notes from the Royal Botanic Garden, Edinburgh ’, and in

'The Rhododendron Society Notes'. Some fifty species of *Rhododendron* were described by him, and one, *R. Taggianum* of Hutchinson, bears his name.

His death robs both the Botanical and the Horticultural world of an experienced worker and reliable authority.

J. M. COWAN.

GEORGE MALCOLM THOMSON, who died on the 25 August 1933, had been for many years one of the best known naturalists in New Zealand. He was born in Calcutta in 1848, and was educated in Edinburgh at the High School and the University. When he was twenty years of age his family moved to New Zealand and for some years he was engaged in farming, later becoming a school master. From 1877 to 1903 he was science master in the Dunedin High Schools, and after retirement he carried on business as an analyst and scientific consultant.

For more than forty years he took an active part in public life, being largely instrumental in setting up technical classes which ultimately gave rise to the Technical College of Dunedin, and other civic and especially educational projects were initiated or actively furthered by him. He entered political life in 1908, when he was elected to the House of Representatives as member for Dunedin. Ten years later he was appointed to the Legislative Council and served for two terms of seven years on that body. One of his sons, the late Dr. J. Allan Thomson, was the first New Zealand Rhodes Scholar to go to Oxford; he served on the Geological Survey of New Zealand and was later Director of the Dominion Museum at Wellington. Another son died in France in 1918 after three and a half years of active service.

Mr. Thomson wrote numerous papers on the fauna and flora of New Zealand, the greater number being published in the 'Transactions and Proceedings of the New Zealand Institute', while several contributions from his pen dealing with New Zealand Crustacea were published in our own *Proceedings and Transactions*.

A little book on 'Ferns and Fern Allies of New Zealand' was published by him as long ago as 1882 and several other volumes dealing with natural history subjects were also published in New Zealand. His most important work, however, was 'The Naturalisation of Animals and Plants in New Zealand' published by the Cambridge Press in 1922. This volume is an invaluable record of facts, extremely difficult to collect elsewhere, regarding the changes produced in the fauna and flora of New Zealand by accidental or intentional introductions. One of Mr. Thomson's most important discoveries is recorded in his paper 'On a Freshwater Schizopod from Tasmania' published in our *Transactions* in 1894.



John Bale Sans & Demelston, Ltd London

PROF. S. H. VINES, D.Sc., F.R.S.
President, 1900-1904.

(From the painting by the Hon. John Collier, 1905)

This 'Freshwater Schizopod' was named by him *Anaspides tasmaniae*, and proved to be no Schizopod at all but the first discovered living representative of the otherwise extinct group of Syncarida. It goes without saying that much has had to be added to or corrected in Mr. Thomson's descriptions of this and other Crustacea, but his pioneer work, which prepared the way for later writers, is deserving of very high appreciation.

Although the present writer never met Mr. Thomson, he had been in active though intermittent correspondence with him for forty years and up to within a few weeks of his death. His letters conveyed the impression, which was confirmed by many common friends, of a genial and kindly personality and of a keen and sympathetic interest in all the doings of men and in all the aspects of nature. W. T. CALMAN.

SYDNEY HOWARD VINES (1849-1934).—A distinguished botanist, who presided from 1900 to 1904 over this Society, has been removed by the death of Professor Sydney Howard Vines, F.R.S., which took place at Exmouth on 4 April 1934, in his eighty-fifth year. In 1919 he had retired after thirty years' service as Professor in Oxford, and lived quietly at Exmouth, delighting in his garden, and solacing himself with music, he being no mean performer on the pianoforte, and in his earlier years an attractive singer of German *Lieder*. His efficient administration of the Botanical School in Oxford, by which he was known to the present generation, was by no means the most essential benefit of his life to Science. Few of our younger botanists will be aware how great a part Vines played in Cambridge, in the 'seventies and 'eighties of the last century. His death gives the natural occasion for reminding a forgetful world of the plight of botanical study in Britain some sixty years ago. For instance, in the early 'seventies, a youth might go up to Cambridge, already with his botanical aspirations aroused by delving into Carpenter's 'Microscope' and the 'Micrographical Dictionary', by collecting in the field, and perhaps by amateurish use of the microscope, to find very meagre opportunity for advance. Henslow, who had held the Botanical Chair at Cambridge till 1860, had, it is true, stimulated his pupils to observation and experiment; but under Babington, who followed him, the work of the botanical department as specified in the Calendar consisted only in an elementary course of lectures chiefly in Descriptive Botany, during the Easter Term, with 'herborising excursions should the circumstances permit'. There was no laboratory, and no course of practical teaching. Cambridge was not alone in this: for in Britain generally the stream of botanical observation had drifted

into the dry channels of classification, chiefly of flowering plants. Cambridge was indeed a fair type of the Universities of the period immediately following the publication of the 'Origin of Species'. Moreover, the teaching of the time was mainly oral: authoritative statement by the teacher had usurped the place of personal observation by the pupil. This was the position at Cambridge when in 1872 Vines entered as a undergraduate of Christ's College.

But a change of method was nascent from an unexpected quarter. Dean Farrar, himself a classical master, had already advocated the teaching of science in English Public Schools at a meeting of the British Association at Nottingham, in 1866, with Huxley in the Chair. This led to the introduction of Science into their stereotyped curricula, but as a literary cult rather than as an observational study. It was the passage of Mr. Foster's Education Act in 1870, and its application to the National Schools, that gave Huxley himself his opportunity. His official centre was at the Royal College of Science, South Kensington; and here the revolution in the teaching of biological science in Britain took place under his hands. If in accordance with the Act science was to be included in the time-tables of the National Schools, it would first be necessary to teach the teachers. A makeshift course for schoolmasters was held under Huxley at South Kensington in 1871, but the first regularly organised course was carried out in the new laboratory at the Royal College of Science in 1872, under the title of Elementary Instruction in Biology. A lecture of one hour each morning preceded four hours of practical work in verification of facts cognate to it. This elementary course soon branched into independent treatment of animals and plants. The first course in Botany was given by Thiselton-Dyer in 1873, and it was repeated in subsequent years. Vines cooperated with Dyer in these early efforts. They stayed together at Kew, where Dyer had recently been appointed assistant director, and there they carried out the preparatory work for the course. Thus the revolution in teaching the Science of Botany was initiated at South Kensington, though it was linked in early stages with Kew. The Universities themselves took as yet no direct part. It was through Vines that the spirit of this new teaching was imparted to Cambridge. Here it involved not only his personal effort, but even his financial support. It immediately took root, and has resulted in the school as it now is. This preliminary sketch of scientific history forms a necessary introduction to any true estimate of the life-work of our late ex-President.

Vines was born in London, on the last day of 1849. In his

boyhood his father and the family spent some years ranching in Paraguay. He was educated first at a Moravian school in Germany, and there laid the foundation of his command of the German tongue. Later he attended Dr. Dawes's school at Surbiton, and in due course entered to study for the medical profession at Guy's, where he developed a special interest in animal physiology. It was probably this that led to his being selected as a demonstrator to some of the earliest practical classes of Huxley at South Kensington. It is difficult now to specify with which of these annual classes he was engaged; but his duties with them must have been spliced into the vacations of his own course at Cambridge, for he entered there at Christ's College in 1872, and was elected to a scholarship. He graduated B.Sc. in London in 1873, and D.Sc. in 1879. Meanwhile, his undergraduate course in Cambridge culminated in his taking the first place in the Natural Sciences Tripos of 1875, with distinction in Botany. In 1876 he was elected Fellow and Lecturer of his College, and he began to lecture there on Botany, though he had as yet no opportunity for carrying on any practical work. The writer attended the second and succeeding terms of his lectures, and found them more helpful to an aspiring botanist than any others in Cambridge, except perhaps those of Michael Foster. They were given in an ordinary lecture-room, and the only illustration available was by drawing on a small blackboard. His experience and practical knowledge, Vines says in the 'New Phytologist', vol. xxiv, p. 1, were up to the year 1877 limited to what he had acquired when assisting Thiselton-Dyer in the courses conducted by him at the Royal College of Science at South Kensington in 1875 and 1876. It therefore seemed to him essential to equip himself for future work by attending some well-known laboratory. His thoughts naturally turned to Germany, and without hesitation to Sachs at Würzburg. He set out in March 1877, and the writer, still an undergraduate of Trinity, joined him there in June for the remainder of the Summer Semester. Returning to Cambridge in the autumn the first laboratory classes in Botany open to undergraduates were started, in a room lent by Michael Foster in the new physiological department. The microscopes used were Vines's own property, and doubtless much of the apparatus and reagents besides. It was in fact a personal enterprise—the University officially stood by and watched. The Professor of Botany never entered the room, so far as the writer can remember; but if he had he would have witnessed a scene the like of which can never recur. The practical class numbered six or eight, all working for honours. The period was at the climax

of interest in apical segmentation, marked by the publication of Sachs's stimulating memoir 'Ueber die Anordnung der Zellen in jüngsten Pflanzentheilen'. In the summer Sachs himself had given us each a copy of it, and Vines was lecturing on the topic. Foremost among us in enthusiasm was Marshall Ward, a recruit recently found by Dyer and Vines at South Kensington. The excitement as we verified the facts first revealed in German laboratories was intense: we felt we were seeing under the guidance of Vines, and indirectly of Sachs himself, things never observed before in British laboratories. In the cooler light of the present century the facts of segmentation may not now appear so vital as they did then: it was the atmosphere of revelation that mattered, and its effect on those who breathed it.

As Vines's courses of instruction in Cambridge developed, he again felt it difficult to do justice to the various branches of the subject, and that he needed more study: particularly he wished to learn the modern methods of cultivation of Fungi. The laboratory of de Bary at Strassburg was at that time the chief centre of activity in this branch, and in the summer of 1879 Vines made a short visit, which was repeated and extended in January 1880. Here again the writer was closely associated with him. In April of 1880 Vines returned to Würzburg, and there he found D. H. Scott studying with Sachs for his Ph.D., which he took in the following year 'summa cum laude'. This visit completed Vines's foreign studies, and he settled down to teaching in Cambridge. In this he was joined by Francis Darwin, who returned to Cambridge soon after his father's death in 1882, and developed specially the classes in experimental physiology. In 1883 Vines was appointed Reader in Botany, a position which he held till 1888, when he was transferred to the Chair of Botany in Oxford, vacated by the return of Bayley Balfour to his native Edinburgh. Those who witnessed at Cambridge the successive steps in development of 'The New Botany' will be best able to estimate the debt owed to Vines as the personal founder of the school, which was soon expanded further under the hands of those who were for the most part his own pupils.

During those German 'Wanderjahre', and particularly in sundry expeditions into the Black Forest and the Vosges, Vines proved himself a charming companion; no less at Cambridge was he a welcome presence in Hall or in Combination Room. His conversation was varied and humorous. In the case of the writer, to these qualities was added a community of musical taste. This drew us together more nearly in the period of travel than at any subsequent time. After his marriage in 1884 and his transfer to Oxford in 1888, he became centred in his laboratory and his garden. He

seldom attended meetings of the British Association or of other learned societies—excepting at the time of his service on the Council of the Royal Society (1900-2) and of his Presidency of the Linnean Society (1900-4). The latter was an official relation which gave him undisguised pleasure. It is marked on the walls of the Lecture-room by an excellent portrait by the Hon. John Collier. During the years of his Professorship in Oxford Headington Hill and the Botanic Garden were his chief centres. The consequence of this was that to the younger generation, excepting those at Oxford, he became a name rather than a known personality, greatly to the loss of botanists at large. Latterly, to his old friends a visit to him in his remote retirement at Exmouth was an occasional pleasure, brightened by gleams of the old Vines of earlier years.

At Oxford, in 1888, he entered a department already re-organized by that ardent revolutionary Bayley Balfour. It had become the most compact, beautiful, though historically the most venerable foundation for Botany in Britain, with its walled garden alongside its laboratories. Here Vines was called upon to develop rather than to create. Everyone will agree as to the efficiency of his tenure, with its expansion of the school in numbers and its cooperation with the growing Department of Forestry. But it could not repeat that nascent stimulus which marked the earlier years at Cambridge. He devoted himself to his department and to his own continued researches.

We have seen how from the first Vines as a medical student had a leaning towards Physiology—he adhered to this in his researches throughout life. It is true that in his earlier years he wrote several papers of a morphological character: but these were all theoretical or critical, not organographic. Nevertheless, he stimulated such observation in others, and naturally included that branch in his text-books: but he never adopted it himself as a subject of practical investigation. His first paper was the outcome of his work in Sachs's laboratory, and it was published in the Würzburg 'Arbeiten' in 1878, the subject being 'The influence of light upon (1) the growth of leaves, and (2) upon unicellular organs'. About the same time, in an ingenious discussion on the Proembryo of *Chara* (1878), he introduced the word 'aposporous' as being symmetrical with the word 'apogamous' applied by de Bary to certain aberrant Ferns. The argument has been disposed of for *Chara* by later cytological observations, but the term remains in the more familiar form of 'apospory', as applied in other examples. His real and permanent interest was however, in metabolism, and particularly in the storage and transfer of proteids. Already in 1878 he published the results of his investigations on aleurone grains: and it is interesting

to note that his last contribution was on the proteases of plants (February 1930). Here he contends that there are two kinds of proteolytic enzymes in plants, and he throws doubt upon Willstätter's objections to the idea of a specific protease-splitting enzyme. On such subjects Vines had published no less than thirteen papers in the 'Annals of Botany' between 1897 and 1910, and these constitute his most substantial contribution as an investigator in recent years. He never worked up these studies into book-form: perhaps because he felt that the questions that immediately interested him were still *sub judice*. It is therefore difficult to assess at their true value the more or less scattered data.

He did, however, take his full share in didactic writing. He contributed the Chapters on laboratory methods and microchemical reactions to the 'Course of Practical Instruction in Botany' issued by Messrs. Macmillan in 1888. This work ran through successive editions, and was finally transformed into 'Practical Botany for Beginners', which is still running. Vines also adapted Prantl's 'Text-book of Botany' for the use of English students, and in 1895 it took final form in the text-book which bore his own name. But his most distinctive work was the volume of 'Lectures on the Physiology of Plants', published in 1886 by the Cambridge Press. At the time of its appearance it was regarded as the first-fruits of the renaissance in this country of the physiological branch of the Science of Botany. The text was clear in style, and skilful in the arrangement of the matter. It was not a manual for the beginner, but was intended as a guide for more advanced students. This volume had a good measure of success. It introduced views on photosynthesis and metabolism which were new to readers in Britain, though current in special treatises abroad. It was never continued to a second edition: but at its time it found no competitor among British authors. A much wider appeal had been made in 1882 by the second English edition of Sachs's celebrated text-book, for the production of which, through the Oxford Press, Vines was wholly responsible. It superseded the first edition produced in 1875 by Bennett and Thiselton-Dyer. This volume held its own as a general text-book in Britain till 1887, when the descriptive section of it was brought up to date by Goebel, and an English edition was produced by the Oxford Press as 'Outlines of Special Morphology'.

Vines was one of the group of botanists who, under the leadership of Bayley Balfour, formed a committee for the foundation of the 'Annals of Botany'. The first volume was published in 1887 through the Oxford Press. When in 1888 Balfour left Oxford, and Vines succeeded him as Professor, he became the chief editor, and continued in that office till

1899. In fact, he guided what is now a leading journal, with its 48th volume in course of production, through the critical years of infancy. This service forms a fitting complement to his pioneer work in the rejuvenation of botanical study in Britain. For all this he has earned the warm gratitude of those who now enjoy the fruits of his labours.

His style even as a young lecturer was easy and effective, with occasional streaks of humour. Even in the 'seventies it was apparent that his mind was acquisitive and critical rather than actively constructive. He would give a most exact and luminous analysis of the work of others, and balance conflicting opinions to a nicety, giving evidence of a wide study of sources. But in those days he seldom wound up a discussion with any expression of his own definite conclusion. It may be a question for students of didactics how far that method is effective as against an enthusiastic advocacy of a personal view. The latter method is not a serious danger in the way of the best pupils: for, even if the view prove to be wrong, they learn by example how to form their own opinions and to develop powers of criticism. To use Huxley's well-known metaphor: 'they learn to distinguish between a dashing excursion of Uhlans, and a forward movement of the main body'. Vines's most extensive venture into the philosophical side of the science was in his article on the Morphology of Plants, written for the Eleventh Edition of the 'Encyclopaedia Britannica' (1910-1); there he discussed with singular clearness the question of causality of adaptation.

As already stated, Vines married in 1888, and his family consists of a daughter and two sons, one of whom is Professor of English Literature at Hull. At Oxford he lived first at Iffley, but he soon moved to Headington Hill. On retirement in 1919 to Exmouth he continued his activity in horticulture under most favourable circumstances: also his music till deafness closed upon him. A more serious trouble of his later years was the fracture of the neck of the femur, which crippled him. Nevertheless, he wrote to me cheerfully in December 1933: and so in a spirit of fortitude ended a friendship of nearly sixty years.

The portrait reproduced here (Plate 2) is from the oil painting by the Hon. John Collier in the Society's collection.

F. O. BOWER.

BENEFACTIONS

LIST *in accordance with Bye-Laws, Chap. XVII. Sect. 1, of all Donations of the amount or value of Twenty pounds and upwards, received during the past Twenty years.*

1914

Royal Society : Grant towards Miss Gibbs's paper on the Flora of British North Borneo, £50.

Miss Foot : Cost of illustration of her paper on *Euschistus*.

The Trustees of the Percy Sladen Memorial Fund : Third Donation towards the fifth volume, £10.

The same : First Donation towards the sixth volume, £190.

1915

The Trustees of the Percy Sladen Memorial Fund : Second Donation towards the sixth volume, £80.

Miss Foot : Cost of second paper on *Euschistus*, £32 10s.

Royal Society : Donations towards the cost of a paper by Mrs. Arber, D.Sc., £40.

The same : towards paper on Utakwa River plants by Mr. H. N. Ridley, C.M.G., F.R.S., £50.

Miss Marietta Pallis : Instalment of cost of her paper on *Plav*, £30.

Thomas Henry Riches, Esq. : Dr. A. R. Wallace's library on Natural History.

Sir Frank Crisp, Bt. : New shelving for Wallace's Volumes.

1916

Mr. E. Heron-Allen : Contribution to cost of paper on Foraminifera of N.W. Scotland, £44.

Messrs. H. Takeda and C. West : Contribution towards the illustration of their paper, £40.

Royal Society : Contribution towards the illustration of two papers by Prof. Dendy, £40.

The same : Contribution towards Mr. Swynnerton's paper on Form and Colouring, £70.

The High Commissioner for the Union of South Africa, per Dr. J. D. F. Gilchrist, for the illustration of his paper on *Jasus Lalandii*, £30.

Miss Marietta Pallis: Balance of cost of her paper on Plav, £90 16s. 6d.

Sir Frank Crisp, Bt.: Phototyped copy of Dioscorides from the 'Codex Anicae Julianae' at Vienna.

1917

British Ornithologists' Union, etc.: Contribution towards cost of Mr. H. N. Ridley's paper, £20.

The Royal Society: Second contribution towards the printing of Mr. C. F. M. Swynnerton's paper on Form and Colouring, £75.

Sir Frank Crisp, Bt.: 'Lindenia', Ghent, 1891-1901. 17 vols. sm. fol.

1919

Dr. B. Daydon Jackson: MS. index to Linnean Society's Journal, Botany, vols. xxi-xl (1884-1912) and the botanic entries in the 'Proceedings' for the same period.

1920

The Royal Society: Third contribution towards the printing of Mr. C. F. M. Swynnerton's paper as above, £50.

The High Commissioner for the Union of South Africa, for the printing of Dr. J. D. F. Gilchrist's paper on *Jasus Lalandii*, Part II, £60.

1921

The Percy Sladen Memorial Fund: Additional Grant in aid of publication of 'Transactions', 2nd ser., Zoology, vol. xvii, part 4, £72 10s.

The same: Grant in aid of publication of four papers on the Houtman Abrolhos Islands, £100.

The Royal Society: Donation in aid of papers by Mr. N. E. Brown and Mr. S. L. Moore, £90.

Dr. W. Rushton Parker: Donation of a large series of portraits of Naturalists and Persons after whom Genera have been named, and work on rearrangement and annotation of the entire collection.

- Prof. C. S. Sargent, F.M.L.S. : Eight volumes issued by the Arnold Arboretum including 'The Bradley Bibliography'.
- Dr. B. Daydon Jackson : MS. Catalogue of each sheet in the Linnean Herbarium ; bound in two volumes folio.

1922

- The late Sir Joseph Hooker : Donation of his Medals and Decorations. (Reversion to Linnean Society on Lady Hooker's decease.)
- Anonymous donation in aid of publication of the late Dr. E. A. Newell Arber's paper, entitled 'Critical Studies of Coal-Measure Plant-impressions', £60.
- The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xviii, pt. 1.

1923

- Dr. W. Rushton Parker : (1) Donation of Oxford New English Dictionary ; vols. i-x, 1888-1928, and Supplement, 1933, 4to. (2) Encyclopaedia Britannica : ed. XI, Cambridge, 1920-2. 32 vols. 4to.
- E. Heron-Allen, Esq., F.R.S. : Contribution of £25 towards the cost of paper on the Foraminifera of Lord Howe Island.

1924

- The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xviii, pt. 2.

1925

- Mr. Reginald Cory : New Presidential Chair, emblazoned with the Arms of the Society.

1926

- Subscription portrait of Dr. B. D. Jackson, R.N.O.
- Mr. A. D. Michael : A large number of Books and Pamphlets from his Library.
- The late Mr. A. O. Walker : £200 free of Legacy Duty.
- An Anonymous Donor : £100 to establish a Fellowship in memory of the late Prof. E. A. Minchin, F.R.S., Sec.L.S.

The Royal Society: Donation in aid of publication of Mr. G. P. Farran's paper on Biscayan Plankton.—Part 14. The Copepoda, £60.

The late Mr. Frank Morey: £100 free of Legacy Duty.

The late Mr. George Lewis: Books and pamphlets on Entomological subjects.

Capt. E. G. Spencer-Churchill: A copy of a collotype reproduction of 'The herbal of Apuleius Barbarus . . . (MS. Bodley 130)'.

The Percy Sladen Memorial Fund: Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix, pt. 1.

1927

The late Mrs. Mary Anne Stebbing: £100 less Legacy Duty.

1928

Carnegie United Kingdom Trust: £666 13s. 4d. for purchase of books.

The Royal Society: £160 (£85 in aid of the publication of Dr. G. Enderlein's paper on 'Die Copeognathen der Seychellen', £75 in aid of Mr. C. V. B. Marquand's paper on 'The Botanical Collections made by Capt. F. Kingdon Ward in the Eastern Himalaya and Tibet in 1924-5').

1929

Carnegie United Kingdom Trust: £666 13s. 4d. for purchase of books.

The Percy Sladen Memorial Fund: £100 in aid of the publication of papers on the Fauna of the Paraguayan Chaco.

Carnegie Trust for the Universities of Scotland: £28 in aid of the publication of papers on the Fauna of the Paraguayan Chaco.

1930

Carnegie United Kingdom Trust: £666 13s. 4d. for purchase of books.

An Anonymous Donor: £23 towards the purchase of an Epidiascope.

The Royal Society: £100 in aid of the publication of Mr. H. W. Pugsley's paper 'A revision of the British *Euphrasiae*' and Dr. T. A. Sprague's paper 'The Herbal of Leonhart Fuchs'.

Mrs. B. Daydon Jackson (the late) : valuable reversion under her Will after three life-tenants shall have died.

Mr. B. B. Woodward (the late) and Mr. A. S. Kennard : a portion of Mr. Woodward's scientific library and reversion of the remainder.

1931

Miss E. C. Hatchett Jackson : Bust of Charles Hatchett, F.L.S., by Chantrey.

Major Vivian Seymer : Volumes from the Library of Henry Seymer.

Exors. of the late Dr. E. J. Bles : Donation in aid of colour collotype plates to illustrate Dr. Karl Peter's paper on *Xenopus laevis*, £100.

Dr. Francis Pierrepont Barnard : Bequest of Sir James E. Smith's seal, his collection of seal impressions, and some portraits.

The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix, pt. 2.

1932

Mr. Francis Druce : Donation towards the cost of new books, £50.

The Royal Society : Donation in aid of the publication of papers resulting from Dr. Worthington's Expedition to the East African Lakes, £75.

Subscription portrait of the late Professor Julius von Sachs, F.M.L.S.

Cambridge Expedition to the East African Lakes, 1930-31 (Dr. E. B. Worthington, leader).—Unexpended balance of expedition funds, for the publication of the scientific results, £175.

Carnegie Institution of Washington : Donation of a considerable number of its publications.

1933

The Royal Society : Donation in aid of the publication of Dr. H. Boschma's paper 'The Rhizocephala in the collection of the British Museum', £60.

The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix, pt. 3.

1934

- Mr. Francis Druce : Certain legal expenses connected with the Society's interest in the Will of the late Mrs. Jane Jackson, £33 14s.
- Mr. Warren R. Dawson, F.R.S.E. : Compilation of ' Catalogue of the Manuscripts in the Library of the Linnean Society of London.—Part 1. The Smith Papers ' ; and cost of binding the additional series of correspondence, etc.
- The Royal Society : Donation in aid of the publication of Dr. G. S. Carter's paper, ' The fresh waters of the rain-forest areas of British Guiana ', and Mr. H. N. Dixon's paper, ' A contribution to the Moss flora of Borneo ', £85.
- The Misses Phipps Tiarks : Copy of portrait of N. B. Ward, F.R.S., F.L.S., by an unknown artist ; engraving after Knight's portrait ; drawing of Ward's conservatory ; and his ' Pitt Club ' medal.
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TREASURER'S ACCOUNTS FOR THE

(Presented at the Anniversary

*Receipts and Payments of the Linnean Society***General**

	RECEIPTS	£	s.	d.	£	s.	d.
To Balance at 1 May 1933		622	0	10			
„ Cash in hand		12	16	7			
					634	17	5
„ Admission Fees					20	0	0
„ Arrears of Annual Contributions		48	0	0			
„ Annual Contributions for year		2441	2	0			
Do. in advance		109	0	0			
					2598	2	0
„ Interest on Investments (including Income Tax recovered)					304	16	11
Do. Deposit					6	15	8
„ Sales of Publications :—							
Transactions		24	17	1			
Journals		182	10	1			
Proceedings		12	9	10			
Library Catalogue		1	8	9			
					221	5	9
„ Donations in aid of Publications					60	0	0
„ Donations for General Purposes					1	0	0
„ Miscellaneous Receipts					33	6	2
					£3880	3	11

Library

	RECEIPTS	£	s.	d.
To Balance 1 May 1933		66	4	1
„ Interest on Investments (including Income Tax recovered)		50	0	5
„ Transferred from General Account		500	0	0
		£616	4	6

Fellows Postal

	£	s.	d.
To Balance at 1 May 1933	62	10	0
„ Deposits during year	9	10	6
	£72	0	6

YEAR ENDED 30 APRIL 1934.

Meeting, 24 May 1934.)

*from 1 May 1933 to 30 April 1934.***Account**

	PAYMENTS	£	s.	d.	£	s.	d.
By Coal, Electric Current, and Gas.....					84	9	8
„ Furniture.....					9	12	6
„ Repairs: Sundry					78	3	6
„ Taxes and Insurance					62	16	0
„ Miscellaneous Printing and Stationery.....					143	6	4
„ Petty Expenses (including Tea and Postage)					184	3	7
„ Publications:—							
Printing.....	730	16	6				
Illustrations.....	98	15	0				
Distribution.....	54	18	9				
					884	10	3
„ Salaries and Wages, etc.					1128	10	0
„ Transferred to Library Account					500	0	0
„ Zoological Record: Donation for 1933 volume					15	0	0
„ Purchase of £96 6s. 1d. 3½ per cent. Conversion Stock (Staff Pension Fund)					100	0	0
„ Linnean Medal					14	10	0
„ Balance at 30 April 1934	658	16	7				
„ Cash in hand.....	16	5	6				
					675	2	1
					<u>£3880</u>	<u>3</u>	<u>11</u>

Account

	PAYMENTS	£	s.	d.
By Books.....		11	7	11
„ Periodicals.....		422	19	9
„ Binding		152	11	3
„ Balance at 30 April 1934		29	5	7
		<u>£616</u>	<u>4</u>	<u>6</u>

Account

	£	s.	d.
By Postage during year.....	17	2	11
„ Balance at 30 April 1934	54	17	7
	<u>£72</u>	<u>0</u>	<u>6</u>

Separate Account

	£	s.	d.
To Balance at 1 May 1933 :—			
Westwood Fund	£91	18	2
Trail Award Fund	11	1	8
Crisp Award Fund	46	14	7
Hooker Lecture Fund	103	11	6
Goodenough Fund	24	0	10
Linnean History Fund	21	9	6
Minchin Fellowship Fund	4	5	0
	293	1	3
„ Interest on Investments (including Income Tax recovered) :—			
Westwood Fund	£9	12	2
Trail Award Fund	3	10	0
Crisp Award Fund	7	10	0
Hooker Lecture Fund	22	0	10
Goodenough Fund	9	0	10
Minchin Fellowship Fund	5	0	0
Staff Pension Fund	27	5	2
	83	19	0
By Goodenough Fund :—			
Purchase of £21 11s. 5d. Metropolitan Water Board 3 per cent. „B” Stock	£20	6	6
Transferred to Annual Contributions	4	0	0
	24	6	6
„ Hooker Lecture Fund :—			
Cost of printing 1933 Lecture..	32	8	11
Purchase of £29 9s. 9d. Metropolitan Water Board 3 per cent. „B” Stock	27	13	8
	60	2	7
„ Minchin Fellowship Fund :—			
Transferred to Annual Contributions	4	0	0
„ Westwood Fund :—			
Purchase of £67 12s. 7d. India 3½ per cent. Stock	62	9	10
Cost of Illustrations	8	14	6
	71	4	4
„ Staff Pension Fund :—			
Purchase of £26 12s. 7d. 3½ per cent. Conversion Stock	27	5	2
„ Linnean History Fund :—			
Grant in aid of expenses of preparation of History	21	9	6
„ Balance at 30 April 1934 :—			
Westwood Fund	£20	6	0
Trail Award Fund	14	11	8
Crisp Award Fund	54	4	7
Hooker Lecture Fund	65	9	9
Goodenough Fund	8	15	2
Minchin Fellowship Fund	5	5	0
	163	12	2

Investments on 30 April 1934

			Market Value, 30 April 1934.	
			£	s. d.
<i>General Account</i>				
Metropolitan 3 per cent. Stock 1941	£	s. d.	1025	0 0
India 3 per cent. Stock			1024	@ 102½
Eastern Bengal Railway 4 per cent. Irredeemable Debenture Stock			936	@ 78
Great Western Railway 4 per cent. Debenture Stock			1005	@ 100½
London Midland & Scottish Railway 4 per cent. Preference Stock			1085	@ 108½
London County 5 per cent. Stock 1940-44			243	@ 78
London County 5 per cent. Stock 1940-44			3658	@ 111
			£7952	18 4
<i>Library Account</i>				
Fourth Bridge Railway 4 per cent. Stock (Bentham Bequest)	£	s. d.	456	15 0
4½ per cent. Conversion Stock 1940-44 (Walker and Morey Bequests)			222	@ 101½
East Indian Railway 3½ per cent. Debenture Stock (Tagart Bequest)			474	@ 111
London County 5 per cent. Stock 1940-60 (Stebbing Bequest)			98	@ 89½
			£1251	6 4
<i>Separate Account</i>				
Metropolitan Water Board 3 per cent. "B" Stock (Westwood Fund)	£	s. d.	207	17 3
Ditto			597	@ 89½
Ditto			146	@ 89½
New South Wales 3½ per cent. Stock, 1930-50 (Trail Award Fund)			99	@ 99½
2½ per cent. Consolidated Stock (Crisp Award Fund)			237	@ 79
India 3½ per cent. Stock (Westwood Fund)			116	@ 90
Ditto			55	@ 90
Ditto			111	@ 90
London County 5 per cent. Stock 1940-60 (Minchin Fellowship Fund)			111	@ 111
3½ per cent. Conversion Stock (Staff Pension Fund)			851	@ 103½
(£12 4s. 0d. Ditto, to be transferred on 1 May 1934.)			£2534	7 11

FRANCIS DRUCE, *Treasurer.*

We have (in conjunction with the Professional Auditor, who certifies as to all details) audited the Accounts of the Society for the year ended 30 April 1934, and found them correct. We have verified the Investments and Bank Balances.

Dated this 8 May 1934.

W. B. KEEN, *Chartered Accountant.*

F. E. WEISS,
 J. RAMSBOTTOM,
 D. J. SCOURFIELD,
 N. B. KINNEAR,
 E. M. WAKEFIELD,
 H. W. PUGSLEY,

Auditors.

ADDITIONS AND DONATIONS

TO THE

LIBRARY

1933-34

Note.—Separate copies of papers which are included in periodicals received by the Library are no longer catalogued. Names of donors are given in square brackets.

- Alzamora, M. Massuti.** Contribución al estudio de los infusorios. (Nota tercera.) Nuevos Tintinnidos de la bahia de Palma de Mallorca. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 76, 1933, pp. 1-14.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- American Fern Journal.** Vol. 19→ 8vo. Lancaster, Pa., 1929→
- American Museum of Natural History.** Central Asiatic Expeditions under the Leadership of ROY CHAPMAN ANDREWS. Preliminary contributions in Geology, Palaeontology, Archaeology, Botany, and Zoology. Vol. 1, 1918-25; Vol. 2, 1926-29. 8vo. [THE ROYAL SOCIETY.]
- Andrews, R. C.** See American Museum of Natural History.
- Armstrong, H. E.** Our need to honour Huxley's will. Huxley Memorial Lecture, 1933. Pp. 34. 8vo. London, 1933. [IMPERIAL COLL. SCI. & TECHN.]
- Audas, J. W.** General observations on the Australian Flora. (Australian Assoc. Adv. Sci. 1928, pp. 23.) 8vo. [AUTHOR.]
- Australian Vegetation. (Science Forum, 1933, pp. 7.) 8vo. [AUTHOR.]
- Banks, G.** See Willcocks, T.
- Barlow, N.** See Darwin, Charles.
- Barraud, P. J.** Fauna of British India. Diptera, Vol. 5. Pp. xxviii+463. 8vo. London, 1934. [AUTHOR.]
- Bean, W. J.** Trees and Shrubs hardy in the British Isles. Vol. iii. Pp. xiv+517. 8vo. London, [1933].
- Benedict, C. G.** See Benedict, F. G.
- Benedict, F. G., & Benedict, C. G.** Mental effort in relation to gaseous exchange, heart rate, and mechanics of respiration. Pp. 83. 8vo. Washington, 1933. [CARNEGIE INST.]
- Bigelow, H. B.** Studies of the waters on the continental shelf, Cape Cod to Chesapeake Bay.—I. The Cycle of Temperature. (Mass. Inst. Techn. Papers, Vol. 2, No. 4, 1933, pp. 135.) 4to. [MASS. INST. TECHN.]

- Bland-Sutton, Sir John.** Men and Creatures in Uganda. Pp. 252. 8vo. London, 1933. [AUTHOR.]
- Boyle, J. W.** See Utterback, C. L.
- British Museum (Natural History).**
A catalogue of the works of Linnaeus (and publications more immediately relating thereto) preserved in the Libraries of the British Museum (Bloomsbury) and the British Museum (Natural History). Pp. xi+246+68. 4to. London, 1933. [TRUSTEES, BRIT. MUS.]
- A revision of the genus *Leptonema* (Trichoptera). By M. E. MOSELY. Pp. 69. 8vo. London, 1933. [TRUSTEES, BRIT. MUS.]
- The Panorpid Complex in the British Rhaetic and Lias. By R. J. TILLYARD. (British Insects, No. 3.) Pp. 79. 8vo. London, 1933. [TRUSTEES, BRIT. MUS.]
- The Louse as a menace to Man . . . by JAMES WATERSTON. (Economic Series No. 2.) Pp. 20. 8vo. London, 1933. [TRUSTEES, BRIT. MUS.]
- Burr, S., & Turner, D. M.** British Economic Grasses. Pp. 94. 4to. London, 1933.
- Carnegie Institution of Washington.** Contributions to Palaeontology. Studies of the Pliocene Palaeobotany of California, by E. DORF and I. E. WEBBER. Pp. 134. 8vo. Washington, 1933. [CARNEGIE INST.]
- Fossil Floras of Yellowstone National Park and South-eastern Oregon. By C. B. READ and H. D. MACGINITIE. Pp. 68. 8vo. Washington, 1933. [CARNEGIE INST.]
- Carpenter, G. D. Hale.** Mimicry, with a section on its genetic aspect by E. B. FORD. Pp. ix+134. 8vo. London, 1933. [Prof. G. D. HALE CARPENTER.]
- Cauillery, Maurice.** Present theories of evolution and the problem of adaptation. The Joseph Leidy Memorial Lecture in Science. Pp. 19. 8vo. Philadelphia, 1933. [AUTHOR.]
- La Science française depuis le XVII^e siècle. Pp. 214. 8vo. Paris, 1933. [AUTHOR.]
- Central Asiatic Expeditions.** See American Museum of Natural History.
- Ching, R. C.** The studies of Chinese Ferns.—X. (Bull. Fan Mem. Inst. Biol. Vol. 4, 1933, pp. 293-354.) 8vo. [C. CHRISTENSEN.]
- Ching, R. C.** See Christensen, C.
- Christensen, C., & Ching, R. C.** Annotationes et corrigenda ad Wu, Wong et Pong: Polypodiaceae Yaoshanensis, Kwangsi. (Bull. Dept. Biol. Sun Yatsen Univ., No. 6, 1933, pp. 32.) 8vo. [C. CHRISTENSEN.]
- *Sinopteris*, a new fern genus in China. (Bull. Fan Mem. Inst. Biol. Vol. 4, 1933, pp. 355-364.) 8vo. [C. CHRISTENSEN.]
- Christophers, S. R.** Fauna of British India. Diptera, Vol. 4. Pp. xi+371. 8vo. London, 1933. [SECRETARY OF STATE FOR INDIA.]
- Clowes, A. J.** See Discovery Reports. Vol. 9.
- Correns, Carl.** [Collection of 25 separate copies, together with an Obituary Notice by G. HABERLANDT.] [Professor F. E. WEISS.]
- Crookall, R.** The Lithology and Palaeobotany of certain British Coals. (Fuel in Science and Practice, Vol. 12, 1933, pp. 276-279.) 4to. [AUTHOR.]
- Crowther, J. G., edited by.** Biology in Education . . . Pp. x+204. 8vo. London, 1933. [THE PUBLISHER.]
- Dangeard, P. A.** Remarques au sujet de la structure de la cellule végétale et de la cellule animale. Pp. 42. 8vo. s.l.e.a. [1934]. [AUTHOR.]
- Darwin, Charles.** Charles Darwin's Diary of the Voyage of H.M.S. 'Beagle', edited from the MS. by NORA BARLOW. Pp. xxx+442. 8vo. Cambridge, 1933.

- Davy, J. Burt.** Maize its history, cultivation, handling, and uses . . . Pp. xl+831. 8vo. *London*, 1914. [AUTHOR.]
- Dawson, Warren R.** A Leechbook or Collection of medical recipes of the fifteenth century. . . . Pp. 344. 8vo. *London*, 1934. [AUTHOR.]
- De Buen, F.** Campaña del 'Xauen' en aguas de Guipuzcoa (Julio-Agosto 1932) (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 72, 1933, pp. 1-40.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- De Buen, R.** Nuevos datos sobre caracteres oceanográficos del mar de España y Costas de Portugal (Campañas del 'Xauen' en 1932). (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 75, 1933, pp. 1-14.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Contribucion al estudio del relieve del Estrecho de Gibraltar (Campañas del 'Xauen' en 1932). (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 66, 1933, pp. 1-15.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Nuevos datos sobre batimetria de las costas mediterraneas de Marruecos. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 71, 1933, pp. 1-15.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- De Miranda y Rivera, Alvaro.** Ensayo de un catalogo de los crustaceos decapods marinos de España y Marruecos Español. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 67, 1933, pp. 1-72.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Notas Carcinologicas. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 68, 1933, pp. 1-9.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Dioscorides, Pedanios.** The Greek Herbal of Dioscorides. Illustrated by a Byzantine A.D. 512, Englished by JOHN GOODYER A.D. 1655, edited and first printed A.D. 1933 by ROBERT T. GUNTHER. Pp. ix+701. 8vo. *Oxford*, 1934. [Dr. R. T. GUNTHER.]
- Discovery Reports.** Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Vol. 1→ 4to. *Cambridge*, 1929→ [Continued :—]
- Vol. 7 (1933).
 Whaling in the Dominion of New Zealand. By F. D. OMMANNEY. Pp. 239-252.
 Isopod Crustacea.—Part I. The Family Serolidæ. By E. M. SHEPPARD. Pp. 253-362.
 Some aspects of respiration in Blue and Fin Whales. By A. H. LAURIE. Pp. 363-406.
- Vol. 8 (1934).
 Title-page, etc./ Pp. i-viii.
 On the Phytoplankton of the South-West Atlantic and the Bellingshausen Sea, 1929-31. By T. J. HART. Pp. 1-268.
 The Southern Sea Lion, *Otaria byronia* (de Blainville). By J. E. HAMILTON. Pp. 269-318.
 On a new species of mite of the family Halarachnidae from the Southern Sea Lion. By SUSAN FINNEGAN. Pp. 319-328.
 Scyphomedusæ. By G. STIASNY. Pp. 329-396.
- Vol. 9→ (1934→).
 Hydrology of the Bransfield Strait. By A. J. CLOWES. Pp. 1-64.
 Distribution of the Macroplankton in the Atlantic Sector of the Antarctic. By N. A. MACKINTOSH. Pp. 65-160.
 [THE DISCOVERY COMMITTEE.]
- Dorf, E.** See Carnegie Institution of Washington.
- Drummond, J.** See Hutton, F. W.
- Empire Cotton Growing Review (The).** Vol. 9→ 8vo. *London*, 1932→ [Professor F. E. WEISS.]

- Finnegan, Susan.** *See* *Discovery Reports*. Vol. 8.
- Fischer, H.** Die Orchideen Deutschlands und der angrenzenden Gebiete nach Aquarellen von ERICH NELSON. Pp. 48: 21 pls. 4to. *München*, 1931. [Dr. J. BURT DAVY.]
- Flintoff, R. J.** Botanical Nomenclature. (Old Owensian Journ. 1933. pp. 1-8.) 8vo. [AUTHOR.]
- Secondary growths on trees and shrubs in North Yorkshire. (Old Owensian Journ. 1932, pp. 4.) 8vo. [AUTHOR.]
- Ford, E. B.** *See* *Carpenter, G. D. Hale.*
- Gila y Esteban, Frutos A.** Sobre el empleo de distinta "agua patrón" y buretas en la determinación de halógenos (método Mohr-Knudsen) en el agua de mar. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 70, 1933, pp. 1-10.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Goebel, K.** Die Entfaltungsbewegungen der Pflanzen und deren teleologische Deutung. Ergänzungsband zur "Organographie der Pflanzen". Aufl. 2. Pp. x+565. 8vo. *Jena*, 1924.
- Goodyer, John.** *See* *Dioscorides, Pedanios.*
- Gómez, M. L.** Contribución al estudio químico de la algina o ácido alginico. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 74, 1933, pp. 1-98.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Gray, L. C.** History of Agriculture in the Southern United States to 1860. Vols. 1 & 2. Pp. xxii+570; xii+571-1086. 8vo. *Washington*, 1933. [CARNEGIE INST.]
- Green, C. T.** The Flora of the Liverpool district. Ed. 2. Pp. xi+163. 8vo. *Arbroath*, 1933. [AUTHOR.]
- Gunther, R. T.** *See* *Dioscorides, Pedanios.*
- Haberlandt, G.** *See* *Correns, Carl.*
- Hamilton, J. E.** *See* *Discovery Reports*. Vol. 8.
- Hart, T. J.** *See* *Discovery Reports*. Vol. 8.
- Hedrich, A. W.** Monthly estimates of the child population 'susceptible' to measles, 1900-1931, Baltimore, Md. (Amer. Journ. Hygiene, Vol. 17, 1933, pp. 613-636.) 8vo. [AUTHOR.]
- Heidel, W. A.** The Heroic Age of Science: The conception, ideals, and methods of Science among the Ancient Greeks. Pp. vii+203. 8vo. *Baltimore*, 1933. [CARNEGIE INST.]
- Herrero, M. E. S.** Caracteres de la población Sardinera en Santander (Año 1931). (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 73, 1933, pp. 1-29.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Horwood, A. R., & Noel, C. W. F.,** *Earl of Gainsborough.* The Flora of Leicestershire and Rutland . . . Pp. ccxcvii+687. 8vo. *London*, 1933.
- Howard, H.** Eagles and Eagle-like Vultures of the Pleistocene of Rancho La Brea. Pp. 82. 8vo. *Washington*, 1932. [CARNEGIE INST.]
- Hudleston, W. H.** A History of the Dove Family . . . an account of the Dove Marine Laboratory . . . by J. J. LISH and the history and purposes of the Laboratory by Prof. A. MEEK. Pp. x+123. 8vo. *Newcastle-upon-Tyne*, 1910. [Dr. R. T. GUNTHER.]
- Hutton, F. W., & Drummond, J.** The Animals of New Zealand. An account of the Dominion's Air-breathing vertebrates. Ed. 4. Pp. 434. 8vo. *Auckland*, 1923. [Dr. W. RUSSETON PARKER.]
- Jahandiez, E., & Maire, R.** Catalogue des Plantes du Maroc. Vols. 1-3. Pp. xl+159; 160-557; 558-913. 8vo. *Alger*, 1931-34. [R. MAIRE.]
- Johnston, H. H.** Additions to the Flora of Orkney . . . 17th paper. Pp. 12. 8vo. *Edinburgh*, 1934. [AUTHOR.]
- Jordan, Karl.** American Anthribidae. (Nov. Zool. Vol. 11, 1904, pp. 242-309.) 4to.
- Note on a peculiar secondary sexual character found among Geometridae at the sensory organ situated at the base of the abdomen. (Nov. Zool. Vol. 12, 1905, pp. 506-508.) 4to.

- Jordan, Karl.** On the species of *Cricula*, a genus of Saturniidae. (Nov. Zool. Vol. 16, 1909, pp. 300-306.) 4to.
- Contribution to our knowledge of the morphology and systematics of the Polytenidae, a family of Rhynchota parasitic on bats. (Nov. Zool. Vol. 18, 1912, pp. 555-579.) 4to.
- Notes on Arctiidae. (Nov. Zool. Vol. 23, 1916, pp. 124-150.) 4to.
- On the species of *Somabrachys* in the Tring Museum. (Nov. Zool. Vol. 23, 1916, pp. 350-358.) 4to.
- The status of *Platysphinx bourkei* Trimen. (Nov. Zool. Vol. 27, 1920, pp. 163-166.) 4to.
- On the replacement of a lost vein in connection with a stridulating organ in a new Agaristid moth from Madagascar, with descriptions of two new genera. (Nov. Zool. Vol. 28, 1921, pp. 68-74.) 4to.
- On an organ peculiar to the females of some genera of Ludiinae, a subfamily of Saturniidae. (Nov. Zool. Vol. 29, 1922, pp. 247-248.) 4to.
- A monograph of the Saturnian subfamily Ludiinae. (Nov. Zool. Vol. 29, 1922, pp. 249-326.) 4to.
- On the comb-bearing flap present on the fourth abdominal segment in the males of certain Notodontidae. (Nov. Zool. Vol. 30, 1923, pp. 153-154.) 4to.
- On a sensory organ found on the head of many Lepidoptera. (Nov. Zool. Vol. 30, 1923, pp. 155-158.) 4to.
- On the scent-organs in the males of certain American Castniidae. (Nov. Zool. Vol. 30, 1923, pp. 159-162.) 4to.
- A note on the families of moths in which R2 (=vein 5) of the forewing arises from near the centre or from above the centre of the cell. (Nov. Zool. Vol. 30, 1923, pp. 163-166.) 4to.
- Four new Sphingidae discovered by T. R. Bell in North Kanara. (Nov. Zool. Vol. 30, 1923, pp. 186-190.) 4to.
- On the Saturnoidean families Oxytenidae and Cercophanidae. (Nov. Zool. Vol. 31, 1924, pp. 135-193.) 4to.
- On the West African Lymantrid genus *Nyctemera*. (Nov. Zool. Vol. 31, 1924, pp. 217-226.) 4to.
- On *Hypocysta* and some allied genera of Satyrinae (Lep. Rhop.) from New Guinea and the Solomon Islands. (Nov. Zool. Vol. 31, 1924, pp. 279-297.) 4to.
- New Anthribidae. (Nov. Zool. Vol. 31, 1924, pp. 231-255.) 4to.
- On some genera of Anthribidae allied to *Exillis* Pasc. (Nov. Zool. Vol. 31, 1924, pp. 256-260.) 4to.
- On *Delias belladonna* and allied species (Lep. Rhop.). (Nov. Zool. Vol. 32, 1925, pp. 277-287.) 4to.
- On the Latreillei-group of Eastern papilios. (Nov. Zool. Vol. 34, 1928, pp. 159-172.) 4to.
- On some Lepidoptera of special interest, with remarks on morphology and nomenclature. (Nov. Zool. Vol. 34, 1928, pp. 132-146.) 4to.
- Siphonaptera collected during a visit to the Eastern United States of North America in 1927. (Nov. Zool. Vol. 34, 1928, pp. 178-188.) 4to.
- Notes on North American fleas. (Nov. Zool. Vol. 35, 1929, pp. 28-39.) 4to.
- On *Oxyambulyx subtrigilis* and some allied Sphingidae. (Nov. Zool. Vol. 35, 1929, pp. 60-62.) 4to.
- Two new African species of *Ctenophthalmus* (Siphonaptera). (Nov. Zool. Vol. 35, 1929, pp. 165-167.) 4to.
- On *Polyptychus pygarga* and some allied species. (Nov. Zool. Vol. 35, 1929, pp. 187-191.) 4to.

- Jordan, Karl.** On some South African fleas. (Nov. Zool. Vol. 36, 1930, pp. 129-138.) 4to.
- On the geographical variation of the Pine Hawk-moth, *Hyloicus pinastri*. (Nov. Zool. Vol. 36, 1931, pp. 243-249.) 4to.
- On *Cypa decolor* and some allied species (Lepid., Sphingidae). (Nov. Zool. Vol. 36, 1931, pp. 235-242.) 4to.
- Anthribidae versus Platystomidae; Anthribidae collected by F. C. Drescher on the Island of Java; Two new Oriental Anthribidae; Some Anthribidae from Tropical Africa. (Nov. Zool. Vol. 36, 1931, pp. 281-310.) 4to.
- Further records and description of fleas from Ecuador: Three new Old World fleas. (Nov. Zool. Vol. 37, 1931, pp. 135-147.) 4to. [33 papers: THE ROYAL SOCIETY.]
- See **Rothschild, Lionel Walter, Baron.**
- Kuenen, H.** Geology of Coral Reefs. (The Snellius-Expedition... 1929-1930, Vol. 5, Part 2, 1933, pp. 126.) 4to.
- Laurie, A. H.** See **Discovery Reports.** Vol. 7.
- Leach, R.** See **Storey, H. H.**
- Lee, J. R.** The Flora of the Clyde Area... Pp. xvi+391. 8vo. Glasgow, 1933. [THE PUBLISHERS.]
- Lish, J. J.** See **Hudleston, W. H.**
- Love, A. G.** See **Reed, L. J.**
- MacDougal, D. T., & Working, E. B.** The pneumatic system of plants, especially Trees. Pp. 87. 8vo. Washington, 1933. [CARNEGIE INST.]
- MacGinitie, H. D.** See **Carnegie Institution of Washington.**
- McIntosh, W. C.** International Fisheries Investigations (British Section). (Fishing News, 1927, pp. 8.) 8vo. [A. W. SHEPPARD.]
- Mackintosh, N. A.** See **Discovery Reports.** Vol. 9.
- MacLeod, J.** The Quantitative Method in Biology. Ed. 2. Pp. xxiii+228. 8vo. Manchester, 1926. [Professor F. E. WEISS.]
- Maire, R.** See **Jahandiez, E.**
- Martelli, U.** Pandanaceae nuove dell' arcipelago Marquesas. (Mém. Soc. Tosc. Sci. Nat. Vol. 42, 1932, pp. 1-9.) 8vo. [AUTHOR.]
- Notizie sul sottogenere *Vinsonia* e la posizione sistematica del *Pandanus spinifer* Warb. (Nota critica.) (Atti Soc. Tosc. Sci. Nat. Vol. 42, 1932, pp. 3.) 8vo. [AUTHOR.]
- Il *Pandanus platycarpus* Warb. non è di origine africana ma asiatica. (Atti Soc. Tosc. Sci. Nat. Vol. 42, 1932, pp. 3.) 8vo. [AUTHOR.]
- Meek, A.** See **Hudleston, W. H.**
- Meinertzhagen, R.** See **Nicoll, Michael.**
- Meunissier, A.** Résumé des travaux de la section des études scientifiques pendant l'année 1932. (Journ. Soc. Nat. d'Hort. France, 1933, pp. 24.) 8vo. [AUTHOR.]
- Mills, F. W.** An index to the genera and species of the Diatomaceae and their synonyms, 1816-1932. Part 1-→ 4to. London, 1933-→ [AUTHOR.]
- Mosely, M. E.** See **British Museum (Natural History).** A revision of the genus *Leptonema* (Trichoptera).
- Murari, T.** Methods of Livestock Improvement. Pp. xxiii+372. 8vo. Madras, 1931. [AUTHOR.]
- Pastures at the livestock research station, Hosur. (Madras Agric. Journ. Vol. 21, 1932, pp. 7.) 8vo. [AUTHOR.]
- Nannfeldt, J. A.** Studien über die morphologie und systematik der nicht-lichenisierten inoperculaten Discomyceten. Inaugural-Dissertation. Pp. 368. 4to. Uppsala, 1932. [UNIV. UPPSALA.]
- Nelson, E.** See **Fischer, H.**
- Nicoll, Michael, & Meinertzhagen, R.** Nicoll's Birds of Egypt. By R. MEINERTZHAGEN. Vols. 1 & 2. Pp. xvi+348; 349-700. 4to. London, 1930. [Major S. S. FLOWER.]

- Ninni, E.** Primo contributo allo studio dei *Lepadogaster*. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 65, 1933, pp. 36.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Nissen, C.** Die Blütezeit der Pflanzenillustration von 1740 bis 1840. (Philobiblon Zeitsch. Bucherliebhaber, Vol. 6, 1933, pp. 44.) 8vo.
- Noel, C. W. F.,** *Earl of Gainsborough.* See **Horwood, A. R.**
- Nordenstam, Åke.** Marine Isopoda . . . mainly from the South Atlantic. Academic Dissertation. Pp. 284. 4to. *Stockholm*, 1933. [UNIV. UPPSALA.]
- Ommanney, F. D.** See **Discovery Reports.** Vol. 7.
- Pearl, R.** Statistical report on the fifth year's operations of the bureau for contraceptive advice. (Fifth Rept. Bur. Contracept. Advice, 1933, pp. 5-17.) 8vo.
- Some data on fertility and economic status. (Human Biol. Vol. 4, 1932, pp. 525-553.) 8vo.
- Quotations: Tobias Venner and his Via Recta. (Human Biol. Vol. 4, 1932, pp. 558-583.) 8vo.
- America to-day and maybe to-morrow. (Quart. Rev. Biol. Vol. 8, 1933, pp. 96-101.) 8vo.
- Preliminary notes on a co-operative investigation of family limitation. (Quart. Bull. Milbank Mem. Fund, Vol. 11, 1933, pp. 37-60.) 8vo. [5 papers: AUTHOR.]
- Percival, John.** Wheat in Great Britain. Pp. 125. 8vo. *Reading*, 1934. [AUTHOR.]
- Pharmaceutical Society of Great Britain.** Codex Revision Committee: Reports of Pharmacy, Pharmacognosy, and Action and Uses Subcommittees. Pp. 49, 20, 14. 8vo. *London*, 1933. [PHARMACEUTICAL SOC.]
- Ponsonby, Vere Brabazon,** *Earl of Bessborough.* Scientific Union within the Empire. An address delivered before the Royal Canadian Institute, 19 November, 1932. Pp. 16. 8vo. s.l.e.a.
- Potter, M. C.** Bio-electric Potentials. Pp. 43. 8vo. *Cambridge*, 1933. [AUTHOR.]
- Pourbaix, Nelly.** Recherches sur la nutrition des spongiaires. (Notas y Resúmenes, Inst. Español Oceanogr. Ser. 2, No. 69, 1933, pp. 42.) 8vo. [INST. ESPAÑOL OCEANOGR.]
- Rafinesque, C. S.** Analyse de la nature ou tableau de l'Univers et des corps organisés. 8vo. *Palerme*, 1815. (Photostat.) [BRIT. MUS. (NAT. HIST.).]
- Read, C. B.** See **Carnegie Institution of Washington.**
- Redgrove, H. S.** Spices and Condiments. Pp. xviii+361. 8vo. *London*, 1933. [AUTHOR.]
- Reed, L. J., & Love, A. G.** Biometric studies on U.S. army officers: Economic efficiency (length of service) in relation to physical fitness and other factors. (Military Surgeon, Vol. 71, 1932, pp. 231-238.) 8vo.
- Biometric studies on U.S. army officers; somatological norms, correlations, and changes with age. (Human Biol. Vol. 4, 1932, pp. 509-524.) 8vo.
- Biometric studies on U.S. army officers; somatological norms in disease. (Human Biol. Vol. 5, 1933, pp. 61-93.) 8vo. [3 papers: L. J. REED.]
- Regan, C. Tate, & Trewavas, E.** Deep-sea Angler-fishes (Ceratioidea). (The Carlsberg Foundation's Oceanographical Expedition round the World 1928-30, Report No. 2.) Pp. 113. 4to. *Copenhagen*, 1932.
- Rogers, R. S.** Some developments in Orchidology. (Rept. Austr. & N.Z. Assoc. Adv. Sci., Vol. 21, 1933, pp. 330-365.) 8vo. [AUTHOR.]
- Rothschild, Lionel Walter,** *Baron, & Jordan, Karl.* A revision of the Lepidopterous Family Sphingidae. (Nov. Zool. Vol. 9, Suppl. 1903, pp. cxxxv+972.) [THE ROYAL SOCIETY.]

- Royal Horticultural Society. Lily Year Book, 1933. Pp. 243. 8vo. London, 1933. [Major F. C. STERN.]
- Shattuck, G. C., & others. The Peninsula of Yucatan: Medical, Biological, Meteorological and Sociological Studies. Pp. xvii+576 4to. Washington, 1933. [CARNEGIE INST.]
- Sheppard, E. M. See *Discovery Reports*. Vol. 7.
- Silvestri, F. Una escursione in Tunisia (Symphyla, Chilopoda, Diplopoda). (Nat. Siciliano, N.S. Vol. 1, 1896, pp. 143-161.) 4to.
- Contributo alla conoscenza dei Chilopodi e Diplopodi della Sicilia. (Bull. Soc. Entom. Ital. Vol. 29, 1897, pp. 29.) 8vo.
- Ricerche sulla fecondazione di un animale a spermatozoi immobili. (Ric. Lab. Anat. Univ. Roma, Vol. 6, 1898, pp. 255-265.) 4to.
- Diplopoda nova a L. Biró in Nova-Guinea collecta. (Termész. Füzet. Vol. 22, 1899, pp. 205-212.) 8vo.
- Notizie e considerazioni sugli Imenotteri parassiti della Mosca delle olive in Italia. . . (Atti R. Inst. Incoraggiamento Napoli, Vol. 4, 1907, pp. 23.) 4to.
- Descrizione di un nuovo genere di Polydesmoidea (Diplopoda) del Messico. (Boll. Mus. Zool. Anat. comp. Univ. Torino, Vol. 24, 1909, pp. 4.) 8vo.
- Description d'une espèce et d'une variété nouvelles d'Insectes de l'ordre des Thysanoures. . . (Bull. Soc. Amis Sci. Nat. Rouen, 1911, pp. 4.) 8vo.
- Termiti . . . dei grandi laghi dell' Africa equatoriale. (Ann. Mus. Zool. Univ. Napoli, Vol. 3, 1912, pp. 5.) 4to.
- Thysanura della Nuova-Caledonia e delle Isole Loyalty. (Sarasin & Roux, Nova Caledonia, Zool. Vol. 2, 1915, pp. 75-81.) 4to.
- Thysanoures. (Extr. Voyage de M. le baron M. de Rothschild en Ethiopie . . . 1904-5, 1922, pp. 157-165.) 4to.
- Contribuzione allo studio della fauna delle caverne in Liguria. (Boll. Soc. Entom. Ital. Vol. 54, 1922, pp. 18-20.) 8vo.
- Descriptiones termitum in Anglorum Guiana repertorum. (Zoologica, Vol. 3, 1923, pp. 307-321.) 8vo.
- Due novi generi e una nuova specie de Machilidae della Spagna. (Publ. Acad. Ciencias Zaragoza, 1923, pp. 123-131.) 8vo.
- Problemi di entomologia agraria. (Atti Soc. Ital. Progr. Sci. Vol. 13, 1924, pp. 15.) 8vo.
- Descripcion de un nuevo género y tres especies nuevas de Ortheziinae (Hemipt., Coccidae), de España y de Costa Rica. (Bol. R. Soc. Españ. Hist. Nat. Vol. 24, 1924, pp. 8.) 8vo.
- Descripcion de un nuevo género de Polydesmidae (Myriopoda, Diplopoda) de España meridional. (Bol. R. Soc. Españ. Hist. Nat. Vol. 33, 1925, pp. 8.) 8vo.
- Descrizione di tre specie di *Prospaltella* e di una di *Encarsia* (Hym., Chalcididae) parassite di *Aleurocanthus* (Aleyrodidae). ('EOS', Rev. Españ. Entom. Vol. 2, 1926, pp. 179-189.) 8vo.
- Necessita di rafforzare la lotta contro i parassiti delle piante e criteri da seguire. (Nuovi Ann. Agric. Vol. 6, 1926, pp. 89-96.) 8vo.
- Lotta contro alcune cocciniglie degli agrumi. (Nuovi Ann. Agric. Vol. 6, 1926, pp. 97-101.) 8vo.
- Contributions to knowledge of myrmecophilous and termitophilous Arthropoda of China and Formosa. (The China Journ. Vol. 7, 1927, pp. 252-254.) 8vo.
- Contribucion al conocimiento de los Japygidae (Thysan.) de España. ('EOS', Rev. Españ. Entom. Vol. 5, 1929, pp. 81-95.) 8vo.
- Note su Tisanuri Italiani. (Boll. Soc. Entom. Ital. Vol. 61, 1929, pp. 126-130.) 8vo.
- Nuevos Parajapiginos de Africa (Thys., Japygidae): (Mem. R. Soc. Esp. Hist. Nat. Vol. 15, 1929, pp. 221-235.) 8vo.

- Silvestri, F.** Primo contributo alla conoscenza degli Japygidae (Thysanura) dell' Eritrea (Africa or.). (Mem. Soc. Entom. Ital. Vol. 9, 1930, pp. 5-11.) 8vo.
- Descrizione di una nuova specie di *Prospaltella* della Somalia. (Boll. Soc. Entom. Ital. Vol. 63, 1931, pp. 20-22.) 8vo.
- Contributo alla conoscenza dei Campodeidae (Thysanura) delle grotte della Bulgaria. (Bull. Inst. Roy. Hist. Nat. Sofia, Vol. 4, 1931, pp. 97-107.) 4to.
- Istituti materni di alcuni Chilognati. (Atti Soc. Ital. Progr. Sci. Vol. 3, 1932, pp. 128-131.) 8vo.
- A new and extraordinary genus of the diplopod family, Polydesmidae, from British Guiana. (Amer. Mus. Nov. No. 564, 1932, pp. 12.) 8vo.
- Description of a new genus and two new species of South American Diplopoda of the family Polydesmidae. (Amer. Mus. Nov. No. 565, 1932, pp. 4.) 8vo.
- Descripcion de cinco nuevas *Campodea* (Thys.) de Marruecos. (Bol. Soc. Espan. Hist. Nat. Vol. 32, 1932, pp. 75-87.) 8vo.
- The biological control of insects and weed pests. (S. East. Agric. Coll. Journ. 1932, pp. 87-96.) 4to.
- Descrizione di un nuovo genere ecitofilo di Lepismidae (Insecta, Thysanura). (Rev. Entom. Vol. 2, 1932, pp. 133-138.) 8vo.
- Campodeidae (Thysanura) de España. ('EOS', Rev. Españ. Entom. Vol. 8, 1932, pp. 115-164.) 8vo.
- Rapporto tra insetti di piante spontanee e piante coltivate lotta biologica contro piante dannose. (L'Italia Agric. Vol. 70, 1933, pp. 91-119.) 4to. [34 papers: AUTHOR.]
- Sloane, B. L.** See **White, A.**
- Smith, K. M.** Recent Advances in the study of Plant Viruses. Pp. xii+423. 8vo. London, 1933.
- Soule, F. M.** See **Sverdrup, H. U.**
- Stetson, H. C.** See **Villinger, B.**
- Steyn, D. W.** The Toxicology of Plants in South Africa together with a consideration of poisonous foodstuffs and fungi. Pp. xii+631. [8vo. Johannesburg, 1934. [CENTRAL NEWS AGENCY, SOUTH AFRICA.]]
- Stiasny, G.** See **Discovery Reports**. Vol. 8.
- Storey, H. H., & Leach, R.** A sulphur-deficiency disease of the tea bush. (Ann. Applied Biol. Vol. 20, 1933, pp. 23-56.) 8vo. [W. NOWELL.]
- Sunamoto, Etsujiro.** The Elephant. Vols. 1 & 2 [in Japanese]. Pp. 16+66+1152; 44+1153-2169+38+102+6. 8vo. s.l.e.a. [AUTHOR.]
- Sverdrup, H. U., & Soule, F. M.** Scientific results of the 'Nautilus' Expedition, 1931. Parts 1-3. (Mass. Inst. Techn. Papers, Vol. 2, No. 1, 1933, pp. 76.) 4to. [MASS. INST. TECHN.]
- Thompson, W. R.** The Biological Control of Insect and Plant Pests. Pp. 124. 4to. London, 1930. [A. W. SHEPPARD.]
- Tillyard, R. J.** See **British Museum (Natural History)**. The Panorpid Complex in the British Rhaetic and Lias.
- Tornquist, N.** Die Nematodenfamilien Cucullanidae und Camallanidae. . . Pp. xi+441. 8vo. Göteborg, 1931.
- Trewavas, E.** See **Regan, C. Tate.**
- Turner, D. M.** See **Burr, S.**
- Utterback, C. L.** Light penetration in the waters of Southern Alaska. (Journ. Optical Soc. Amer. Vol. 23, 1933, pp. 5.) 8vo. [UNIV. WASHINGTON.]
- Utterback, C. L., & Boyle, J. W.** Light penetration in the waters of the San Juan Archipelago. (Journ. Optical Soc. Amer. Vol. 23, 1933, pp. 10.) 8vo. [UNIV. WASHINGTON.]
- Vaughan, T. W.** Report on species of corals and larger foraminifera collected in Cuba by O. E. Meinzer. (Journ. Wash. Acad. Sci. Vol. 23, 1933, pp. 352-355.) 8vo. [AUTHOR.]

- Vickery, H. B., & others. Chemical Investigations of the Tobacco Plant. Pp. vi+77. 8vo. Washington, 1933. [CARNEGIE INST.]
- Villinger, B., & Stetson, H. C. Scientific results of the 'Nautilus' Expedition, 1931. Parts 4 & 5. (Mass. Inst. Techn. Papers, Vol. 2, No. 3, 1933, pp. 37.) 4to. [MASS. INST. TECHN.]
- Waterston, James. See British Museum (Natural History). The Louse as a menace to Man.
- Webber, I. E. See Carnegie Institution of Washington.
- White, A., & Sloane, B. L. The Stapelieae. Pp. xiv+206. 4to. Pasadena, 1933. [A. WHITE.]
- Wilcox, H. A. The Woodlands and Marshlands of England. Pp. 55. 8vo. Liverpool, 1933. [UNIV. PRESS, LIVERPOOL.]
- Willcocks, T. Flora Poetica; or Poetry on Flowers. With plates by G. BANKS. Pp. xii+336. 12mo. London, 1834. [IDA M. ROPER.]
- Willett, H. C. American air mass properties. (Mass. Inst. Techn. Papers, Vol. 2, No. 2, 1933, pp. 84.) 4to. [MASS. INST. TECHN.]
- Williams, C. B. Observations on the Desert Locust in East Africa from July 1928 to April 1929. (Ann. Applied Biol. Vol. 20, 1933, pp. 463-497.) 8vo. [W. NOWELL.]
- Womersley, H. A possible biological control of the Clover Springtail or Lucerne Flea (*Sminthurus viridis* L.) in Western Australia. (Journ. Council Sci. Indust. Res. 1933, pp. 83-91.) 8vo. [AUTHOR.]
- Working, E. B. See MacDougal, D. T.
- Zschokke, F. Die Tierwelt des Kantons Tessin. Pp. 145. 8vo. Basel, 1928. [AUTHOR.]
- Zuckerman, S. Functional affinities of Man, Monkeys, and Apes. Pp. xviii+203. 8vo. London, 1933. [Dr. E. S. RUSSELL.]
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